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RAND PROJECT
RANDBURG, KERN COUNTY
CALIFORNIA

FINAL
ENVIRONMENTAL IMPACT STATEMENT/
ENVIRONMENTAL IMPACT REPORT

VOLUME II
APPENDICES

State Clearinghouse Number 93042054

APRIL 1995

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County of Kern
Planning Department
Bakersfield, California

Bureau of Land Management
Ridgecrest Resource Area
Ridgecrest, California

RAND PROJECT

KERN COUNTY, CALIFORNIA

FINAL ENVIRONMENTAL IMPACT STATEMENT/ ENVIRONMENTAL IMPACT REPORT VOLUME II

State Clearinghouse Number 93042054

This appendix volume is a companion document to the *Rand Project, Kern County, Final Environmental Impact Statement/Environmental Impact Report, Volume I, Chapters 1 through 14*, USDI, Bureau of Land Management and County of Kern, April, 1995.

For further information regarding the availability of environmental documents for the Rand Project, contact either Kern County or the Bureau of Land Management at:

County of Kern
Planning Department
2700 M Street, Suite 100
Bakersfield, California 93301
ATTN: Planning Department
(805) 861-2615 Phone
(805) 861-2061 Fax

U.S. Bureau of Land Management
Ridgecrest Resource Area
300 South Richmond Road
Ridgecrest, California 93555
ATTN: Ahmed Mohsen

**RAND MINING COMPANY
RAND PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT/
ENVIRONMENTAL IMPACT REPORT
VOLUME II**

TABLE OF CONTENTS

APPENDICES

Appendix A:	Notice of Intent, Notice of Preparation, and Notice of Preparation Distribution List
Appendix B:	Public Comments During the Public Scoping Process
Appendix C:	Rand Mine Expansion Project Soil Resources Inventory, Randsburg, California
Appendix D:	Geologic Time Scale
Appendix E:	Hydrogeological Analysis for Proposed Increased Groundwater Pumpage, Fremont Valley, California, Which Includes Appendices A Through D
Appendix F:	Rand Project Estimated PM ₁₀ and Air Toxics Emissions and Impacts Assessment, Which Includes Appendix I
Appendix G:	Sensitive Floral Species Survey, Vegetation Resources and Baseline Data Assessment, Rand Project, Kern County, California
Appendix H:	Biological Assessment, The Rand Project, Kern County, California
Appendix I:	Bat Survey of Rand Project, Rand Mining District, Kern County, California
Appendix J:	Visual Contrast Rating Forms
Appendix K:	Acoustical Analysis Report for Rand Mining Company Baltic Mine, Randsburg, Kern County, California
Appendix L:	Biological Opinion for the Proposed Expansion of Rand Mining Company's Gold Mining Operations Near Randsburg, Kern County, California (CA-932.5)(1-8-93-F-30)
Appendix M:	Groundwater Monitoring Plan for the Rand Mining Company Production and Monitoring Wells

APPENDIX A

**Notice of Intent, Notice of Preparation
and Notice of Preparation Distribution List**

RECEIVED

AF 900

I. D.

APR 29 1993

NOTICE OF PREPARATION**TO: SEE ATTACHED MAILING LIST****FROM: KERN COUNTY**

**DEPARTMENT OF PLANNING AND DEVELOPMENT SERVICES
2700 'M' STREET, SUITE 100
BAKERSFIELD, CA 93301**

**Contact: Benjamin Guerrero
(805) 861-2615**

**SUBJECT: NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT
(DEIR) REPORT**

The Kern County Department of Planning and Development Services will be the Lead Agency (per CEQA Guidelines Section 15052), and will require that a Project Environmental Impact Report (per CEQA Guidelines Section 15163) be prepared for the project identified below. The document will be a combined Environmental Impact Report (EIR) and Environmental Impact Statement (EIS). We need to know the views of your agency as to the scope and content of the environmental information which are germane to your agency's statutory responsibilities in connection with the proposed project. Your agency will need to use the EIR prepared for our agency when considering your permit or other approval of the project.

The project description, location, and the potential environmental effects are contained in the attached materials.

Due to the time limits mandated by State law, your response must be sent at the earliest possible date but not later than 30 days after receipt of this notice.

Please send your response to Benjamin Guerrero at the address shown above. We will need the name of a contact person in your agency.

**PROJECT TITLE: EA 23-93; CUP #4, Map #115; CUP #8, Map #115-35; CUP #9, Map #136
(Randsburg Mining Company)**

PROJECT LOCATION: Randsburg, Kern County, California

PROJECT DESCRIPTION: Conditional use permit (CUP) applications to allow the expansion of four existing mining operations: Yellow Aster Mine, Baltic Mine, Lamont Mine, and Descarga Area. The proposed Rand Project will also consist of associated exploration activities, implementation of wildlife impact reduction measures, conducting reclamation activities as found in the reclamation plan, construction and maintenance of roads, and upgrading of an existing water well field and pipelines. Specific components of the project include expansion of the three existing open pits (Yellow Aster, Baltic, and Lamont); development of associated satellite deposits; development of two waste rock stockpiles; development of two heap leach pads with associated solution ditches and ponds; development of two mineral recovery plants; and other ancillary facilities. As currently outlined in the CUP application(s), the proposed Rand Project will encompass a maximum of 1,020 acres of surface disturbance associated with the expansion activities. The extracted ore would be leached on a 270-acre site located in Lamont valley and on a 60-acre site in the Descarga Area. Seventy-two million tons of waste rock would be deposited on the 260-acre West Valley site and the 170-acre Lamont Valley site. Additionally, the Baltic waste rock stockpile would be expanded by 30 acres. Portions of the proposed Rand Project would occupy land that has been

CUP 4, M.115; CUP 8, M.115-35; CUP 9, M.136

DISTRIBUTION LIST Non-MetropolitanProject # **23-93****RAND MINING**

CITIES

☐ Arvin
☐ Bakersfield
☐ California City
☐ Delano
☐ Maricopa
☐ McFarland
☐ Ridgcrest
☐ Shafter
☐ Taft
☐ Tehachapi
☐ Wasco

COUNTIES

☐ Inyo
☐ Kings
☐ Los Angeles
☒ San Bernardino
☐ San Luis Obispo
☐ Santa Barbara
☐ Tulare
☐ Ventura

FEDERAL AGENCIES

☒ BLM /Ridgcrest / ~~Bakersfield~~
☒ EPA
☒ Fish and Wildlife/ Sacra / ~~Ventura~~
☐ Forest Svc
☒ Soil Conservation/ **TEHAC.**

COUNTY OF KERN

☐ Agriculture
☒ Air Pollution
☐ Airports
☐ Community Development
☒ County Clerk
☐ C.A.O /Fiscal Analysis
☒ Engineering Services
☒ Environmental Health
☒ Fire
☐ Library/
☐ Library/
☒ Museum
☐ PADS - Plan Development
☐ PADS - Plan Implementation
☒ Parks and Recreation
☒ Sheriff / ~~Health Analysis~~
☒ Transportation
☒ Waste Management

LOCAL AGENCIES

☒ School **SIERRA SANDS**
☐ School
☐ Superintendent of Schools
☐ Kern COG
☐ LAFCO
☐ Com Svc Dist
☒ Water District **RAND COMM.**
☒ Water Agency
☐ Parks & Rec
☐ San Joaquin APCD
☐ Other
☐ Other
☐ Other

OTHER

☐ Audubon Society/Sacramento
☐ Central Valley Rock, Sand, Gravel
☐ Pacific Bell /Bakersfield/Fresno/
☐ PG&E /Bakersfield
☐ PG&E/Planning /Fresno/
☐ Sierra Club (Early Consult. Cover)
☒ So. Cal Edison /Bakersfield/ ~~San Bernardino~~
☐ So. Cal Gas
☒ Other **Desert Tort. Pres. Comm. Long B**
☒ Other **E.K. Res. Conserv. Dist.**
☐ Other
☐ Other

STATE AGENCIES

☒ Air Resources Board
☐ Archaeological Information Center
☐ Conservation
☒ CalTrans/District ~~10~~ /9/
☒ Clearing House (**10** copies)
☒ Conservation /Environmental Division
☐ CSU Bakersfield/Library
☐ Division Oil & Gas /Bakersfield/ Sacramento/
☐ Energy Commission
☒ Fish and Game/ Fresno
☒ Fish and Game /Asserson/ /~~Conservation~~ /~~Comm~~
☐ Food and Agriculture /Sacramento/
☒ Health Services /Fresno/ /~~Sacramento~~
☐ Highway Patrol
☒ Historic Preservation
☐ Integrated Waste Management
☐ Parks and Recreation
☒ Public Utilities Commission
☐ Reclamation Board
☒ Regional Water Quality /~~Conservation~~ /Lahontan/
☐ State Lands Commission
☒ Water Resources

previously disturbed by underground mining and prospecting operations which began in the 1890s and by Rand's ongoing operations within the project area.

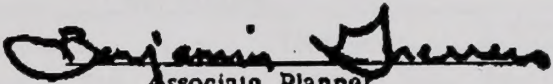
A scoping meeting has been scheduled April 21, 1993, in the Rand District Community Building in the community of Johannesburg, California.

Date: April 14, 1993

Signature:

Title:

Telephone:


Associate Planner

(805) 861-2615

Attachments

Reference: California Code of Regulations, Title 14, (CEQA Guidelines) Sections 15082(a), 15103, 15375

Notice of Completion**Appendix F**

See NOTE below

Mail to: State Clearinghouse, 1400 Tenth Street, Sacramento, CA 95814 916/445-0613

SCH # _____

Project Title: EA 23-93; CUP 4, Map 115; CUP 8, Map 115-35; CUP 9, Map 136

Lead Agency: Kern County Planning & Development Services

Contact Person: Benjamin Guerrero

Street Address: 2700 "M" Street, Suite 100

Phone: (805) 861-2615

City: Bakersfield, CA Zip: 93301

County: Kern

Project Location

County: Kern

City/Nearest Community: Randsburg

Cross Streets: Randsburg Avenue

Assessor's Parcel No. 182-100-03

Section: 34, 35, 1, 2, 3 Twp. 29S

Total Acres: 1,020

Range: 40E Base: MDB&M

Within 2 Miles: State Hwy #: 395

Waterways:

Airports:

Railways:

Schools:

Document TypeCEQA: ☒ NOP☐ Supplement/SubsequentNEPA: ☐ NOI

Other:

☒ Joint Document☐ Early Cons☐ EIR (Prior SCH No.)☐ EA☐ Final Document☐ Neg Dec☐ Other☐ Draft EIS☐ Other☐ Draft EIR☐ FONSI**Local Action Type**☐ General Plan Update☐ Specific Plan☐ Rezone☐ Annexation☐ General Plan Amendment☐ Master Plan☐ Prezone☐ Redevelopment☐ General Plan Element☐ Planned Unit Development☒ Use Permit☐ Coastal Permit☐ Community Plan☐ Site Plan☐ Land Division (Subdivision, Parcel Map, Tract Map, etc.)☐ Other**Development Type**☐ Residential: Units _____ Acres _____☐ Water Facilities: Type _____ MGD _____☐ Office: Sq.ft. _____ Acres _____ Employees _____☐ Transportation: Type _____☐ Commercial: Sq.ft. _____ Acres _____ Employees _____☒ Mining: Mineral Gold & silver ore☐ Industrial: Sq.ft. _____ Acres _____ Employees _____☐ Power: Type _____ Watts _____☐ Educational☐ Waste Treatment: Type _____☐ Recreational☐ Hazardous Waste: Type _____☐ Other: _____**Project Issues Discussed in Document**☐ Aesthetic/Visual☐ Flood Plain/Flooding☐ Schools/Universities☐ Water Quality☐ Agricultural Land☐ Forest Land/Fire Hazard☐ Septic Systems☒ Water Supply/Groundwater☐ Air Quality☐ Geologic/Seismic☐ Sewer Capacity☐ Wetland/Riparian☐ Archeological/Historical☒ Minerals☐ Soil Erosion/Compaction/Grading☐ Wildlife☐ Coastal Zone☐ Noise☐ Solid Waste☐ Growth Inducing☒ Drainage/Absorption☐ Population/Housing Balance☐ Toxic/Hazardous☐ Landuse☐ Economic/Jobs☐ Public Services/Facilities☐ Traffic/Circulation☐ Cumulative Effects☐ Fiscal☐ Recreation/Parks☐ Vegetation☐ Other**Present Land Use/Zoning/General Plan Use**

Mining/NR (20), A-1/8.4 (Mineral Petroleum), 1.1 (Federal Lands)

Project Description

Conditional use permit (CUP) applications to allow the expansion of 4 existing mining operations: Yellow Aster Mine, Baltic Mine, Lamont Mine, & Descarga Area. The proposed Rand Project will also consist of associated exploration activities, implementation of wildlife impact reduction measures, conducting reclamation activities as found in the reclamation plan, construction & maintenance of roads, & upgrading of an existing water well field & pipelines. Specific components of the project include expansion of the 3 existing open pits (Yellow Aster, Baltic, & Lamont); development of associated satellite deposits; development of 2 waste rock stockpiles; development of 2 heap leach pads with associated solution ditches & ponds; development of 2 mineral recovery plants; & other ancillary facilities. As currently outlined in the CUP application(s), the proposed Rand Project will encompass a maximum of 1,020 acres of surface disturbance associated with the expansion activities.

NOTE: Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. from a Notice of Preparation or previous draft document) please fill it in.

Revised October 198

Funds cannot be used to supplant current funding for existing activities (see section on Supplantation of Existing Funds). Allowable items of expenditure for which grant support may be requested include:

- Salaries, wages, and fringe benefits of professional and other supporting staff engaged in the project activities;
- Travel directly related to carrying out service activities under the approved project;
- Supplies, communications, and rental of equipment and space directly related to approved project activities;
- Contracts for performance of activities under the approved project; and
- Other such items necessary to support approved project activities.

Funds cannot be used for the purchase of a facility to house any portion of the proposed program. Any funds proposed to be utilized for renovation expenses must be detailed and linked directly to programmatic activities. Any lease arrangements in association with the proposed program utilizing PHS funds may not extend beyond the project period or cover non-programmatic activities.

Grant funds may not be used to pay for inpatient detoxification or treatment, or to purchase housing. However, funds may be used to pay for one-time rental assistance.

Alterations and Renovations

Costs for alterations and renovations (A&R) will be allowable only where such alterations and renovations are necessary for the success of the program. However, as subject to the PHS Grants Policy Statement, the maximum amount of funds budgeted or used for A&R under a single grant during three consecutive budget periods (whether or not the 3 years overlap two distinct competitive segments of support) cannot exceed the lesser of \$150,000 or 25% of the total funds reasonably expected to be awarded by the PHS for direct costs for such three-year period. (The maximum amount of PHS grant funds that may be applied to any single A&R project is \$150,000.) Construction costs are not allowed.

Administrative Costs

No less than 95 percent of the total direct costs awarded to each State must be allocated to the subrecipients. The State may recover the lesser of its actual costs of administration (direct and indirect costs) of the grant, or 5 percent of the total direct costs of awards made to subrecipients within the State. This amount should cover personnel, travel

and other related costs associated with the administration of the grant.

States that own and operate the community mental health system are excepted from the above ruling and will be allowed to retain 100 percent of the grant funds to implement the program. Not more than 5% of the total direct costs may be used to cover the actual costs of administration (direct and indirect costs) of the grant.

Other Costs

A working group comprised of the Project Director from the State applicant agency and Project Coordinators from each of the two communities will meet with CMHS staff to facilitate evaluation research activities and discuss programmatic issues. Applicants should budget for the attendance of the Project Director and the Project Coordinators for each of the communities at three 3-day meetings per year in the Washington, DC area.

Reporting Requirements

Quarterly, annual and final progress reports and financial status reports will be required and specified to awardees in accord with PHS Grants Policy requirements.

Contacts for Additional Information

Questions concerning program issues may be directed to: Frances L. Randolph, Dr. P.H. or Walter Leginski, Ph.D., Homeless Program Section, Adult Serious Mental Illnesses Branch, Division of Demonstration Programs, Center for Mental Health Services, 5600 Fishers Lane, room 7C-08, Rockville, MD 20857, (301) 443-3706.

Questions regarding grants management issues may be directed to: Mr. Steve Hudak, Grants Management Officer, Center for Mental Health Services, 5600 Fishers Lane, room 7C-23, Rockville, MD 20857, (301) 443-4456.

Authority and Regulations

Statutory Authority: Cooperative agreements awarded under this RFA are authorized under Section 520A of the Public Health Service Act, as amended (42 U.S.C. 290bb-32).

Applicable Federal Regulations: Federal regulations at 45 CFR parts 74 and 92, generic requirements concerning the administration of grants, are applicable to these awards.

PHS Grants Policy Statement: Grants must be administered in accordance with the PHS Grants Policy Statement (Revised October 1, 1990).

Catalog of Federal Domestic Assistance Number: The Catalog of

Federal Domestic Assistance (CFDA) number for this program is 93.125.

Dated: March 31, 1993.

Joseph R. Leone,
Acting Deputy Administrator, Substance Abuse, Mental Health and Services Administration.

[FR Doc. 93-7880 Filed 4-5-93; 8:45 am]
BILLING CODE 5100-20-M

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

ICA-065-03-4191-031

Notice of Intent; Proposed Rand Project, Kern County, California

AGENCY: Bureau of Land Management, Interior

ACTION: Notice of intent.

SUMMARY: Notice is hereby given that the Bureau of Land Management and County of Kern will prepare a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) to assess the potential environmental impacts that may be associated with development of the proposed Rand Project. A public scoping meeting has been scheduled in connection with the preparation of that document. Rand Mining, a wholly owned subsidiary of Glamis Gold Inc., has filed applications with the Bureau and County for development of an open-pit, heap-leach gold mine in the Randsburg Area of Kern County, California. The Rand Project is located approximately 20 miles south of Ridgecrest, California. The project will ultimately affect approximately 1000 acres, and includes the following activities: Mining, construction and operation of the heap-leach processing facilities, construction and maintenance of roads, upgrading of an existing water well field and pipeline, and reclamation of disturbed lands. The EIS/EIR will be prepared by the Bureau and County with the assistance of an independent environmental consulting firm selected by the agencies. The following issues have been preliminarily identified for analysis: Water resources, vegetation and wildlife resources (including special interest species), cultural resources, recreation, visual resources, air quality, and public health and safety. In accordance with the National Environmental Policy Act and California Environmental Quality Act requirements, the EIS/EIR will also consider alternatives to the proposed action. Alternatives and additional issues may be identified as a result of the public scoping process.

One scoping meeting is scheduled for public and agency input to determine the full scope of issues which should be addressed in the EIS/EIR. The date, time and location of the public meeting is as follows:

Date and time	Location
April 21, 1993 7:00 p.m.	Johannesburg, California, Rand District Community Building, Hwy 395, Johan- nesburg, CA 93528.

This notice is a request for environmental information that you or your organization feels should be addressed in the EIS/EIR. Detailed information may be included in your response. Written comments should be sent to the address below no later than May 6, 1993.

FOR FURTHER INFORMATION CONTACT:
Dave Taylor, Project Manager, Bureau of Land Management, Ridgecrest Resource Area, 300 S. Richmond Rd., Ridgecrest, CA 93555, 819/375-7125.

Dated: March 31, 1993.

Lee Delaney,
Area Manager.

[FR Doc. 93-7928 Filed 4-5-93; 8:45 am].
BILLING CODE 4310-40-M

[CO-050-4210-05; COC-52557]

Realty Action

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice of Realty Action COC-52557; Recreation and Public Purposes Classification for Lease and Sale, Boulder County, Colorado.

SUMMARY: The following public lands have been found suitable and are hereby classified for lease and sale under the Recreation and Public Purposes Act (R&PP), as amended (43 U.S.C. 869 et seq.), and are segregated from the public land laws including the general mining laws, except for applications under the R&PP Act.

Sixth Principal Meridian, Colorado

T.1N., R.71W., Section 8: Lots 171 and 183.

The site contains approximately 9.07 acres.

The Sunshine Fire Protection District has filed an application for this site for use as a fire station.

DATES: Until May 24, 1993, interested parties may submit comments on this action.

ADDRESSES: Comments should be directed to the Canon City District Manager, BLM, P.O. Box 2200, Canon City, CO 81215-2200.

FOR FURTHER INFORMATION CONTACT:

Priscilla McLain at (303) 239-3712.

SUPPLEMENTARY INFORMATION: Any adverse comments will be evaluated by the State Director, who may sustain, vacate or modify this realty action. In the absence of any objections this proposal will become final.

Dennie R. Sparks,

District Manager.

[FR Doc. 93-7903 Filed 4-5-93; 8:45 am]

BILLING CODE 4310-40-M

[NM-080-03-4210-04; NMNM 82227]

Realty Action, Exchange, Valencia County, New Mexico

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice of Realty Action (NORA) for proposed land exchange.

SUMMARY: The following described public land located in Valencia County, New Mexico, has been determined to be suitable for disposal by exchange under section 206 of the Federal Land Policy and Management Act of 1976, 43 U.S.C. 1716.

New Mexico Principal Meridian

T. 6N., R. 3E.

Sec. 7, lots 3 to 5, inclusive;

Sec. 12, lots 2 to 4, inclusive;

T. 6N., R. 4E.

Sec. 3;

Sec. 4, N $\frac{1}{2}$ SE $\frac{1}{4}$, and E $\frac{1}{2}$ SE $\frac{1}{4}$;

Sec. 5, NW $\frac{1}{4}$;

Sec. 7, lots 1 and 2, E $\frac{1}{2}$ NW $\frac{1}{4}$, and NE $\frac{1}{4}$;

Sec. 8, lots 3 and 4;

Sec. 9, lots 1 to 4, inclusive and N $\frac{1}{2}$;

Sec. 10, lots 1 to 4 inclusive and N $\frac{1}{2}$;

Sec. 11, lot 1 to 4 inclusive and N $\frac{1}{2}$;

Sec. 12 lots 1 to 4 inclusive, N $\frac{1}{2}$, and E $\frac{1}{2}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$.

T. 7N., R. 4E.

Sec. 25, SE $\frac{1}{4}$;

Sec. 26, lots 1 to 4 inclusive, S $\frac{1}{2}$ N $\frac{1}{2}$, and S $\frac{1}{2}$;

Sec. 27, lots 1 to 4 inclusive, S $\frac{1}{2}$ N $\frac{1}{2}$, and S $\frac{1}{2}$;

Sec. 28, lots 1 to 3 inclusive and

SW $\frac{1}{4}$ SW $\frac{1}{4}$;

Sec. 33;

Sec. 35, W $\frac{1}{2}$ NE $\frac{1}{4}$ and E $\frac{1}{2}$ NW $\frac{1}{4}$.

Containing 5,845.87 acres.

DATES: Comments must be received by May 21, 1993.

ADDRESSES: Comments should be sent to the District Manager, BLM, 1717 West Second Street, Roswell, New Mexico, 88201.

FOR FURTHER INFORMATION CONTACT:
Hans Sallani, BLM, Roswell Resource Area, 505-824-1790.

SUPPLEMENTARY INFORMATION: The above described land is a part of the previously-noticed Rio Bonito Exchange. This notice includes the

Valencia County public land in the Exchange as selected lands. The parties to the Exchange, as well as the terms and conditions of the Exchange, are fully described in previous Federal Register notices. The NORA for the Rio Bonito Exchange was published in the Federal Register on Thursday, April 9, 1992, at 12332, of Vol. 57, No. 69, and amended in the Federal Register on Wednesday, May 13, 1992, at 20503, of Vol. 57, No. 93, and corrected in the Federal Register on Tuesday, May 19, 1992, at 21332, Vol. 57, No. 97. The Exchange is scheduled to occur prior to the end of 1993.

The BLM has prepared an Environmental Assessment to address impacts of the Exchange and this document is available for review. The Exchange is in conformance with the Rio Puerco Resource Management Plan and the Amended West Roswell Management Framework Plan but not with Lincoln County's Interim Land Use Plan of January 14, 1992.

Lands transferred from the United States will contain the following patent reservations:

1. A reservation to the United States of a right-of-way for ditches or canals constructed by the authority of the United States in accordance with 43 U.S.C. 945.

2. The reservation to the United States of all minerals in the land.

3. A reservation to the United States, U.S. Forest Service, for access to the Cibola National Forest boundary at Lolito Springs.

The land will be conveyed subject to all valid existing rights, rights-of-way, easements, and leases of record, including a Federal grazing lease issued to Cordova Ranch Partnership for Allotment 0447 on March 1, 1992, for a term of 10 years. A Notice to cancel this grazing lease was issued on December 8, 1992, and the grazing lease may be cancelled by the BLM any time after December 8, 1994, in accordance with the Notice and 43 Code of Federal Regulations 4110.4-2(b). The rights of the United States as lessor of the lease will be reserved until the lease terminates or is cancelled or relinquished.

Publication of this notice in the Federal Register will segregate the public land from all appropriations under the public land laws including the mining and mineral leasing laws. This segregation will terminate upon issuance of patent or 2 years from the date of this notice or upon publication of a termination of segregation.

For a period of 45 days from the date of publication of this notice in the Federal Register, interested parties may

United States Department of the Interior
Bureau of Land Management

News Release

AF-900
II.D.



Release date: IMMEDIATELY, May 4, 1993
Contact: Doran Sanchez, 909/697-5215

CA-060-93-27

BLM Extends Comment Period on Proposed Rand Mining Project

HAND DELIVERED
BY D. TAYLOR
ON 05/05/93 -
THIS WAS
GIVEN TO
ALL NORM
MEDIA
OUTLETS

The comment period for a proposed mining operation by Rand Mining in the Randsburg area of Kern County has been extended by the Bureau of Land Management to May 18, 1993, to provide the public additional time to submit environmental information relevant to the preparation of a joint draft environmental impact report/environmental impact statement.

Public scoping began on April 6, 1993, coinciding with the publication of a Notice of Intent to prepare the joint EIS/EIR in the Federal Register. A public scoping meeting was held in Johannesburg, California on April 21, 1993, and the public comment period was scheduled to end May 6.

BLM and the County of Kern will prepare the joint EIS/EIR with the assistance of an independent environmental consulting firm to assess potential environmental impacts that may be associated with the proposed mining operation by Rand Mining. Potential impacts include water resources, vegetation and wildlife resources (including special interest species), cultural and visual resources, recreation, air quality, and public health and safety.

Rand Mining, a wholly-owned subsidiary of Glamis Gold Incorporated, proposes to develop an open-pit, heap-leach gold mine near Randsburg, approximately 20 miles south of Ridgecrest. The proposed project would ultimately affect about 1,000 acres and would include mining, construction and operation of the heap-leach processing facilities, road construction and maintenance, upgrading existing water well field and pipeline, and reclamation of disturbed lands.

Written comments concerning the preparation of the Draft EIR/EIS for the proposed Rand Mining Project may be submitted in writing through May 18, 1993, to Mr. Dave Taylor, Project Manager, Bureau of Land Management, 300 South Richmond Road, Ridgecrest, California 93555, or Mr. Benjamin Guerrero, Kern County Department of Planning and Development Services, 2700 M. Street, Suite 100, Bakersfield, California 93301.

-BLM-

RECEIVED
MAY 17 1993

APPENDIX B

Public Comments During the Public Scoping Process

WRITTEN PUBLIC COMMENTS DURING THE NOI/NOP PROCESS FOR THE RAND PROJECT EIS/EIR			
DATE	NAME	ORGANIZATION	COMMENT
04-20-93	Robert J. Ruhnke Chief	Transportation Planning California DOT 500 S. Main Street Bishop, CA 93514	No Comment.
04-20-93	Steve McCalley Director	Kern County EHSD 2700 M St., Suite 300 Bakersfield, CA 93301	No Comment.
04-21-93	Barry Nienke	Kern County DEHS Floodplain Management Section	No Comment.
04-22-93	Joel B. Margolis MW Tech State of California	P.O. Box M Bemcom, CA 93512	<u>LAND USE</u> 1) Access to Government Peak.
04-29-93	Dale Mitchell Regional Manager	CDFG	<u>BIOLOGICAL RESOURCES</u> 1) Adverse impacts to fish, Wildlife, or native plants. 2) Restrict the range or reduce the numbers of a rare or endangered species. 3) May include mitigation measures to reduce project impacts to below significant levels.
05-04-93	Louise A. Richardson President	Rand Communities Water District P.O. Box 198 Randsburg, CA 93555	<u>WATER RESOURCES</u> 1) Water quantity and quality issues related to increased and prolonged use of water from Fremont Valley and potential impacts to Rand Communities Water District wells.

WRITTEN PUBLIC COMMENTS DURING THE NOI/NOP PROCESS FOR THE RAND PROJECT EIS/EIR			
DATE	NAME	ORGANIZATION	COMMENT
05-05-93	Fred Simon Principal Planner	Kern County Transportation Management Department	<u>SOCIOECONOMICS</u> 1) New access points to County maintained roads should be constructed to County standards. 2) Locations of access points approved by County.
05-06-93	Jacqueline Wyland Chief Office of Federal Activities	EPA Region IX 75 Hawthorne Street San Francisco, CA 94105-3901	<u>WATER RESOURCES</u> 1) Compliance with water quality standards. 2) Discuss original drainage, operational drainage and post-reclamation drainage patterns and projects effect on sedimentation. 3) Discuss 100-year flood plain. 4) Discuss potential for contamination of surface flows. 5) How overflows of ponds would be managed. 6) Describe how the toxicity of cyanide would be controlled or eliminated during use in processing and the environmental fate of cyanide after use in mine processes. 7) Discuss water sources and amount used for existing and proposed operations. 8) Discuss acid generation /neutralization potential for waste rock, spent ore and pit walls. 9) Chemical characterization of water in ponds. 10) Describe all monitoring operations and locations.

WRITTEN PUBLIC COMMENTS DURING THE NOI/NOP PROCESS FOR THE RAND PROJECT EIS/EIR			
DATE	NAME	ORGANIZATION	COMMENT
05-06-93 (con't)			<u>AIR RESOURCES</u> 1) Discuss attainment status of area, NAAQS, PSD and SIP, and potential impacts from project and cumulative effects. 2) Impacts to Class I airsheds 3) Discuss applicability of NSPS to project. <u>BIOLOGICAL RESOURCES</u> 1) Discuss potential for poisoning of animals and ESA applicability to project. 2) Discuss avoidance, minimization, and mitigation of losses or modifications of habitat and plant and animal species composition. <u>WASTE ISSUES</u> 1) Discuss applicability of "Bevill rulings" to any activities or processes at the project site. 2) Discuss all components of the waste management and reclamation plans. 3) Discuss the level of bonding appropriate to the intended scale and quality of reclamation and mining waste management. 4) Discuss who is responsible for any post-closure clean-up actions should they be necessary. <u>LAND USE</u> 1) Discuss project's potential impacts to the California Desert Conservation Area, any WSAs or area proposed

WRITTEN PUBLIC COMMENTS DURING THE NOI/NOP PROCESS FOR THE RAND PROJECT EIS/EIR			
DATE	NAME	ORGANIZATION	COMMENT
05-07-93	Roy Ashburn Supervisor	Kern County	<u>WATER RESOURCES</u> 1) Address Rand Communities Water District's Issues.
05-08-93	Frederick L. Ross Commander Northeast Substation Area	Kern County Sheriff's Department 1350 Norris Road Bakersfield, CA 93308	<u>SOCIOECONOMICS</u> 1) Minimal impacts to sheriff's operations.
05-13-93	Barbara Rigg	5442 Backus Road Mojave, CA 93501	<u>AIR RESOURCES</u> 1) Chemical and dust emissions from mine operations.
05-14-93	Stormy Williams	3813 50th Street West Rosamond, CA 93560	<u>AIR RESOURCES</u> 1) Particulate emissions from blasting and dirt road travel. 2) Mercury emissions from processing. 3) Cyanide emissions for spraying of heaps. <u>GEOLOGICAL RESOURCES</u> 1) Ground shaking from blasting operations. <u>WATER RESOURCES</u> 1) Contamination of groundwater. <u>BIOLOGICAL RESOURCES</u> 1) Wildlife mortalities associated with the ponds either to rodents or to bats flying through the net. 2) Effects to wildlife from surface disturbing activities.

WRITTEN PUBLIC COMMENTS DURING THE NOI/NOP PROCESS FOR THE RAND PROJECT EIS/EIR			
DATE	NAME	ORGANIZATION	COMMENT
05-14-93 (con't)			<u>PROJECT ALTERNATIVES</u> 1) Use tanks rather than ponds for cyanide solution storage.
05-21-93	William O'Rulliam Supervisor Solid Waste Program	Kern County EHSD 2700 M St., Suite 300 Bakersfield, CA 93301	<u>WATER RESOURCES</u> 1) Water quality issue related to cross contamination of industrial and domestic water systems. <u>AIR RESOURCES</u> 2) Air quality issue related to situation when lack of water for dust control. What will be impacts from cyanide-laden dust. <u>WASTE ISSUES</u> 3) Identify and discuss all waste streams associated with project. 4) What are NORM levels associated with project and what are impacts.
05-24-93	Terry Murray	Lancaster, CA	<u>AIR RESOURCES</u> 1) Air quality impacts from chemicals used at mine, mercury, PM10

RECEIVED

JUN 03 1993

JUN 01 '93 17:56 BLM-RIDGECREST



Ridgecrest Resource Area
300 S. Richmond Rd.
Ridgecrest, CA 93545

P. 1/2



Fax: (619) 375-1996
COM: (619) 375-7125

FACSIMILE MESSAGE COVER SHEET

To: Dwight Carey Agency/Office F.R.A. Date 6/1/93
From: D. Taylor Office: Ridgecrest Resource Area, CA-065
Subject: Comment Rand Project

Number of Pages (including cover sheet): 2 Time: 5:50

Remarks/Comments: This is the comment that
slipped thru the cracks

RECEIVED FROM

06.01.1993 17:51

P. 1

RECEIVED
BUREAU OF LAND MANAGEMENT

1993 APR 26 PM 12:50 Margolis
P.O. Box M
RIDGECREST RESERVE AREA, CA. 93512
RIDGECREST, CA.

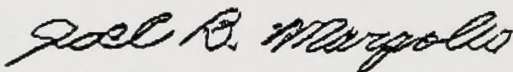
April 22, 1993

BLM
ATTN. Dave Taylor
300 S. Richmond RD.
Ridgecrest, CA. 93555

ATTN. Dave Taylor

I am a MW tech. for the State of Calif. My area of responsibility includes the State's equipment at Govt. Peak. This letter is in regards to the Rand project. The lease holders at Govt. Peak require reliable 24 hour access to this site. The access to this site has changed twice since the Rand mine began operation. One of the actual maintenance or service people were ever notified of these changes, we all had to discover them on our own. Since BLM issues the leases and controls the site, I feel you and Rand mining should be keeping us informed. I also feel that Rand mining should be required to provide access to Govt. Peak from Randsburg-Redrock road. This road should be maintained by them and all users should be provide with a map and directions along with the name of a contact person in case of a road maintenance problem. The operations at Govt. Peak are CRITICAL TO BOTH LAW ENFORCEMENT AND FIRE PROTECTION SERVICES. The cost to LAWFP alone due to a MW outage are over \$200,000.-- an hour. The loss of MW control of the power distribution systems result in a loss of line capacity. This means other more expensive electricity must be purchased or generated. Access to this site was never a problem until the mine began operation, I feel this is a problem that could result in either a large cost loss, or delay needed repairs to critical services. I want to see this problem addressed in the Rand project document. Please call if you have any questions, 619-873-6670.

Sincerely,



Joel B. Margolis

ENVIRONMENTAL HEALTH SERVICES DEPARTMENT

STEVE McCALLEY, R.E.H.S.
DIRECTOR



2700 "M" Street, Suite 300
Bakersfield, CA 93301
(805) 861-3636
(805) 861-3429 FAX

May 21, 1993

Kern County Planning and Developmental Services Department
2700 "M" Street, Suite 100
Bakersfield, CA 93301

Attention: Benjamin Guerrero

SUBJECT: Amendment to Rand Project Conditional Use Permit Application by
Environmental Management Associates (EMA) - March 18, 1993

Dear Mr. Guerrero:

Our Department has reviewed the referenced amended CUP application and submits the following comments for your consideration.

1. We find the preparation of an Environmental Impact Report (EIR) consistent with the scope of this project.
2. The project will require an estimated 500,000 gallons of water per day to conduct operations. This use is divided between non-potable industrial and potable domestic purposes.

The EIR should identify potential backflow or cross-connection hazards and corresponding prevention measures needed to protect the public water supply and on-site distribution system from contamination. A survey of the on-site water distribution system, conducted by an American Water Works Association (AWWA) Certified Specialist, is recommended to provide this information. Recommendations resulting from this survey are subject to approval of the Kern County Environmental Health Services Department, Land Development Program.

The intent of this requirement is to protect public water supplies and on-site potable uses from contamination hazards.

3. In the event of shortage or interruption of service, less water may be available for dust control. Under these circumstances, operations may require modification to prevent off-site dust migration. To what extent, if any, will cyanide-laden dusts migrate from spent ore and sludge residuals? What are the potential health risks and geographic zone of influence associated with this problem? Will off-site residences and the elementary school in Johannesburg be affected by wind-borne contamination?

Kern County Planning & Developmental Services Department
Subject: Amendment to Rand Project CUP Application
May 21, 1993
Page 2

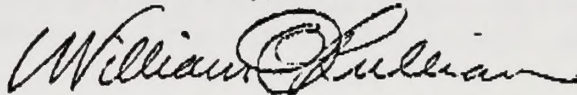
In response to these issues, the EIR should address dust control as a function of continuous maintenance.

4. The disclosure regarding solid waste appears to refer to rock and processed ore. Please identify waste collection, transport and disposal operations as they pertain to other wastestreams, such as demolition material, refractory residues, equipment service and office wastes.
5. Will Naturally Occurring Radioactive Materials (NORM's) be generated as a by-product waste? Some of the unpatented mining claims listed for the Rand Project may also yield uranium. The EIR should identify potential concentrations of low-level radioactive wastes generated as a result of the project. If NORM's are significant, the EIR should further discuss appropriate mitigation measures.

As always, we appreciate the opportunity to comment. Please feel free to call me if you have any questions regarding our response.

Sincerely,

Steve McCalley, Director



By: William O'Rullivan, R.E.H.S.
Environmental Health Specialist IV
Supervisor Solid Waste Program

WO:cas

cc: Kim Cebecioglu, Lahontan-RWQCB
Lloyd Weese, KCEHSD
Cliff Calderwood, KCAPCD

Worullian/rand



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX

75 Hawthorne Street
San Francisco, Ca. 94105-3901

May 6, 1993

RECEIVED
BUREAU OF LAND MANAGEMENT
1993 MAY 10 PM 1:32
RIDGECREST RESOURCE AREA
RIDGECREST, CA.

Dave Taylor
Bureau of Land Management
Ridgecrest Resource Area
300 S. Richmond Road
Ridgecrest, CA 93555

Dear Mr. Taylor:

The Environmental Protection Agency (EPA) has received the notice of intent to prepare an Environmental Impact Statement (EIS) for the Rand Project, Kern County, California. Our review is provided pursuant to the National Environmental Policy Act and Council on Environmental Regulations (40 CFR Parts 1500-1508).

We note that in March, 1993, we provided you with scoping comments for the Briggs Project, Inyo County, which appears to be quite similar to the Rand Project. Please consider our Briggs Project scoping comments as applicable to the Rand Project. For your convenience, we have enclosed a copy of our Briggs comments. The scope of subjects that should be addressed in the EIS includes water resources, air quality, vegetation and wildlife, mining waste and reclamation, and special status lands.

We appreciate the opportunity to comment on the proposed project and request one copy of the EIS when it is available. If you have any questions, please contact Jeanne Geselbracht at (415) 744-1576.

Sincerely,

Jacqueline Wyland, Chief
Office of Federal Activities

Enclosure

cc: Kern County Dept. of Planning and Development Services
Kern County APCD

General Comments

Data on the potential adverse impacts of open-pit mining and heap-leach mining and techniques for mitigating these effects have improved in recent years, although uncertainty remains regarding the long-term effects of land disturbance, mining wastes, groundwater withdrawals, and other products of mining activities. We believe that the Environmental Impact Statement (EIS) for the proposed project should build upon this knowledge to demonstrate that all reasonable alternatives to proposed actions have been thoroughly considered and incorporated into the project. The EIS should provide substantial detail on the means of implementing mitigation measures, and should also identify how monitoring will be set up to ensure compliance and assess effectiveness of mitigation.

Water Resources

1. For each alternative the EIS should discuss the project's compliance with state-adopted, EPA-approved water quality standards. The project planning should be fully coordinated with the California Regional Water Quality Control Board-Lahontan Region to ensure that water quality is protected and beneficial uses are maintained. If the project would require discharges to creeks in the area, the EIS should address the potential effects on water quality, such as thermal changes and increased toxicity and salinity. The effects of such impacts on designated beneficial uses of the streams should be thoroughly considered.

2. Completely describe the original (natural) drainage patterns in the project locale, as well as the drainage patterns of the area during project operations and following reclamation. Include hydrologic and topographic maps of the area. This discussion should encompass effects of the project on erosion potential and sedimentation.

a. Identify whether any components of the proposed project would fall within the 100-year (24 hour storm) flood plain. Discuss the potential for flash floods to transport sediment from disturbed areas to stream channels.

b. Discuss the potential for contamination of surface flows (perennial or from storm events) and rainfall which pass may through tailings disposal facilities or waste rock dumps. Describe mitigation measures to prevent this contamination, including construction of run-on/run-off channels, impermeable covers, and any collection or sedimentation ponds. What provisions would be made for post-operation

surveillance to ensure that stabilization of mining waste sites has been effective? Describe the mitigation actions that would be taken should destabilization be detected and identify who would be responsible for these actions.

3. Discuss how accidental releases of hazardous materials, including overflow from ponds would be handled. Identify the potential impacts resulting from failure of components of the solution containment systems and tailings ponds, and the degree to which impacts would be reversible.

4. EPA regards the use, recycling, and final disposition of cyanide in mining as one of the most problematic and controversial aspects of heap leach operations. The behavior of cyanide in soils and groundwater is complex. Discuss the potential for release of cyanide or other contaminants into the soil and groundwater. The EIS should describe how the toxicity of cyanide would be controlled or eliminated during use in processing, and should discuss the environmental fate of cyanides after use in mine processes.

Cyanide may be more persistent in some environments than would be predicted based on general knowledge of attenuation. This may be the result of a reducing environment or cyanide forming complexes with heavy metals. The EIS should describe the predicted chemistry of cyanide in water and soil at the proposed project site, and the cyanide budget resulting from heap leach processing at similar mines. The discussion should identify the composition and toxicity of cyanide compounds present in waste sites such as tailings impoundments; discuss the potential for cyanide compounds to migrate into surface waters and groundwater, and to decompose to free cyanide; and explain any processes used to destroy cyanide.

5. The EIS should enumerate water sources and estimate rates of water use by the proposed project operations as well as current operations and other related projects. Identify any impacts to wetlands, vegetation and wildlife, and other groundwater-dependent resources as a result of groundwater pumping associated with the proposed project. (See "Vegetation and Wildlife," page 3).

6. Discuss the acid generation/neutralization potential for waste rock, tailings, and pit walls at the site. Describe the leach tests to be conducted on ore and waste rock and provide the results for each test. Describe the quality of waters at any mining sites nearby, particularly older mines, that may be used to predict future acid generation at the Briggs site. Describe and commit to measures to prevent acid generation and any

mitigation measures that may be necessary should prevention measures fail.

7. Provide projected chemical characterization of water in open ponds located at the site, including projected water quality in any open pits following closure.

8. Describe in detail the proposed facility design and operation, including liner and cover specifications, ditches and ponds, and maintenance and monitoring activities to insure integrity of facilities throughout project operations and closure.

9. Describe the locations of all monitoring wells, vadose zone monitoring devices (e.g., suction lysimeters), and points of compliance on the site. The screening intervals, parameters to be monitored, and monitoring frequencies should be discussed.

10. Consult with the U.S. Army Corps of Engineers to determine if the proposed project requires a Section 404 permit under the Clean Water Act. Section 404 regulates the discharge of dredged or fill material into waters of the United States, including wetlands and other "special aquatic sites."

If a permit is required, EPA will review the project for compliance with Federal Guidelines for Specification of Disposal Sites for Dredged or Fill Materials (40 CFR 230), promulgated pursuant to Section 404(b)(1) of the Clean Water Act.

Air quality

1. Discuss the attainment status of the area for priority pollutants. Discuss the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments applicable to air quality in the project area. PSD increments exist for sulfur dioxide, total suspended particulates, and oxides of nitrogen. Discuss impacts to the NAAQS and PSD increments from estimated emissions, considering the cumulative effects from all aspects of mine excavation, construction, operation, and support activities, such as vehicle traffic. BLM should closely coordinate with the Great Basin Unified Air Pollution Control District.

2. PSD increments are highly protective of air quality in Class I areas such as wildernesses and national parks. The PSD increments for total suspended particulates are 5 ug/m³ (annual) and 10 ug/m³ (24-hour). The EIS should identify any Class I areas within at least 100 kilometers of the project site. Class I areas even further away could potentially be affected as well.

BLM should consult with the National Park Service and the U.S. Forest Service for a determination of which areas could be adversely affected by the proposed action. Potential impacts to Class I PSD areas, including visibility impacts, should be discussed.

3. ~~Discuss any mitigation measures necessary to comply with NAAQS, PSD, and the State Implementation Plan (SIP).~~

4. ~~Discuss the applicability and requirements of the New Source Performance Standards for Metallic Mineral Processing Plants (40 CFR part 60.380-386) with respect to the proposed project.~~

5. The EIS should discuss the possibility of an air quality monitoring program which would be implemented to ensure project compliance with all applicable air quality standards and permits.

Vegetation and wildlife

1. Poisoning of animals attracted to waters containing cyanide has been an extremely serious problem with heap leach operations. Discuss the mitigation measures which would be taken to prevent exposure of migratory waterfowl and other wildlife to any toxic waters used in or resulting from processing the ore. ~~Identify how solution impoundments and ditches would be treated to prevent poisonings.~~ Netting and scare tactics are not completely reliable prevention measures. We recommend that serious consideration be given to covering all cyanide solutions on the project site.

2. BLM should work closely with the U.S. Fish and Wildlife Service and the California Department of Fish and Game to determine potential impacts of the project on plant and wildlife species, especially species classified as rare, threatened, endangered, or candidate species on either state or federal lists.

3. The EIS should discuss avoidance, minimization, and mitigation of losses or modification of habitat and plant and animal species composition.

Resource Conservation and Recovery Act

1. The EIS should address whether the "Bevill rulings" to the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, are applicable to any activities or processes at the project site. For the rulings, please refer to the following citations:

o 40 CFR Part 261, Mining Waste Exclusion; Final Rule, Federal Register vol. 54, No. 169, September 1, 1989;

o 40 CFR Parts 260, 261, 262, Mining Waste Exclusion and Definition of Designated Facility; Proposed Rule, Federal Register vol. 54, No. 184, September 25, 1989;

o 40 CFR Parts 260, 261, 262, Mining Waste Exclusion; Section 3010 Notification for Mineral Processing Facilities; Designated Facility Definition; Standards Applicable to Generators of Hazardous Waste; Final Rule, Federal Register vol. 55, No. 15, January 23, 1990.

The EIS should also discuss any measures to be taken at the project site to ensure compliance with applicable RCRA regulations.

Mining Waste Management and Land Reclamation

1. The EIS should discuss the following components of waste management and reclamation plans: (a) a detailed account of measures taken to decommission mine operations, stabilize slopes, and neutralize or cap waste rock, tailings, and leach heaps; (b) identification (including estimated acreages) of the areas targeted for reclamation, and clarification of the intended degree of treatment in each area; (c) estimation of any irrigation requirements; (d) timing of reclamation relative to mining operations and duration of reclamation treatment; (e) standards for determining and means of assuring successful reclamation; and (f) means of assuring that any maintenance required for reclaimed areas would continue after operations cease or while operations are suspended. We recommend that the reclamation plan be coordinated with a site-specific closure plan.

2. The EIS should specify the level of bonding appropriate to the intended scale and quality of reclamation and mining waste management. Also identify who would be responsible for any post-closure cleanup actions should they be necessary.

Special Status Lands

The EIS should discuss the proposed project's potential impacts to the California Desert Conservation Area, any wilderness study areas (WSA), or proposed wilderness areas under S. 21 and H.R. 518 (the California Desert Protection Act). Congress is expected to pass the Act some time this year. If the proposed project is located within a WSA or designated wilderness, BLM must manage the land so as not to impair or

degrade its wilderness values; and the EIS should discuss how this would be accomplished.

Cumulative Impacts

The EIS should address potential cumulative impacts to resources, considering the proposed project in the context of past, current, and reasonably foreseeable future mining and other activities in the project vicinity. The analysis should include a discussion of impacts to water and air quality, hydrology, soils, vegetation, wildlife, and biodiversity.

RAND COMMUNITIES WATER DISTRICT

P.O. BOX 198
RANDSBURG, CALIFORNIA 93554
(619) 374-2414

May 4, 1993

Mr. Dave Taylor
Bureau of Land Management
300 South Richmond
Ridgecrest, CA 93555

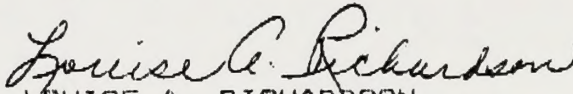
Re: Rand Mining Company
Rand Project
EIS/EIR

Dear Mr. Taylor:

This letter is to request that the Environmental Impact Study presently being conducted by FMA, Inc., address the issue of the increased and prolonged use of water from the aquifer from which the Rand Communities Water District draws its water.

Your immediate attention to this matter is greatly appreciated.

Very truly yours,


LOUISE A. RICHARDSON
President, Rand Communities
Water Board

LAR:cp

CC: Mr. Roy Ashburn

Lancaster, Ca.

May 24, 1993

Benjamin Guerrero
2700 " M " Street; Suite 100
Bakersfield, CA 93301

Dear Mr. Guerrero,

I am adamantly opposing the proposed expansion of the Rand project submitted by Rand Mining Co.

At no time should open cyanide pits be allowed!

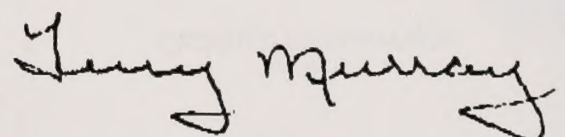
It has been my experience from living within a four mile radius and now a twenty nine mile radius of existing cyanide pits and working mines, that it is dangerous.

While we were told not to worry, (the mines could not be the source of our problems) this is based solely on theory, assumption and calculations. To date no monitoring for chemicals from mine emissions has been done. Valley residents, such as myself, who are sensitive to the chemicals, can co-relate chemical emission with the mining operation. The cyanide pits release emissions continually, being sensitive to temperature change and must be kept at certain P.H. balance or hydrogen cyanide is formed. Low level exposure to hydrogen cyanide over a one to two year period can cause brain malfunction. The ammonia based chemicals used to mix the cyanide in, causes scarring of the lungs and creates severe mucus drainage. Mercury vapor is another big concern because it is tasteless, colorless, and odorless. It causes severe neurologic problems and kidney and liver damage. Hydrogen chloride also used heavy in the mining process can cause scarring of the lungs. Kern County does not have the manpower nor equipment to properly monitor and safeguard the public or the environment from these harmful chemicals.

PM 10 is also a big problem in the CUP. No provisions or mention of how they would control the PM 10 created from blasting. Blasting sends fine PM 10 dust hundreds of feet into the air. An even bigger danger is a natural dustborn fungus found in our desert soil which causes Valley fever. I find it unconscionable that any company or county would consider putting this type of industry in close proximity to the public, especially one mile from a school, needlessly exposing children to these dangers. In March of "89", Cactus Gold mine was found to be releasing massive amounts of mercury vapor into the atmosphere. In May of that year Bakersfield residents were notified of the danger, while we were living downwind and told everything was in compliance. To this date no one has been notified of the mercury release. (High levels of mercury were found off-site by MSHA and Cal E.P.A.

MSHA has also stated that all wells around the mines should be tested for mercury and cyanide contamination. This has not been done. At best the cyanide ponds should be drained and detoxification accomplished somewhere else, at the worst the cyanide solution should be put in an air tight cylinders and leach pads covered. The air continues to be severe! Please help to put an end to the pain and chemical exposure that we are experiencing.

Sincerely,
Terry Murray



RECEIVED

MAY 25 1993

Office Memorandum * KERN COUNTY

EMA Brea

Date: April 21, 1993

To: Planning & Development Services
Environmental Section
William L. Larsen

From: Engineering & Survey Services
Floodplain Management Section
Barry Nienke

Phone: 861-2201

Subject: File #23-93

CUP #4, Map #115
CUP #8, Map #115-35
CUP #9, Map #136

Our Section has reviewed the attached subject documents and have the following comments:

1. From the information supplied with the Notice of Public Hearing, we have no comments or recommendations regarding the above project at this time.

MAIL TO:

ENVL MGMT ASSOC.

405 S. State College

BLVD., Suite 211

Brea, CA.

ATTN:
Dwight L.
Carey

Dwight

5/93

Attached please find
Comments on Land Project.
Others will follow -

B.G.



PLANNING & DEVELOPMENT SERVICES
Resource Management Agency

BENJAMIN GUERRERO
PLANNER

Office Memorandum * KERN COUNTY

Date: April 21, 1993

To: Planning & Development Services
Environmental Section
William L. Larsen

From: Engineering & Survey Services
Floodplain Management Section
Barry Nienke

Phone: 861-2201

Subject: File #23-93

CUP #4, Map #115
CUP #8, Map #115-35
CUP #9, Map #136

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DEPARTMENT OF TRANSPORTATION

500 SOUTH MAIN STREET
BISHOP, CA 93514

(619) 872-0689



April 20, 1993

Ker-395-0.20

Kern County
Dept. of Planning & Development
2700 "M" Street, Suite 100
Bakersfield, CA 93301

Attention Benjamin Guerrero

PROJECT TITLE: EA 23-93; CUP #4, Map #115; CUP #8, Map #115-35;
CUP #9, Map #136 (Randsburg Mining Company)

We have reviewed the above referenced document and have no
comments to offer.

A handwritten signature in cursive script, reading 'Robert J. Ruhnke'.

ROBERT J. RUHNKE, Chief
Transportation Planning
Branch B

1993 APR 21 11:11:27

ENVIRONMENTAL HEALTH SERVICES DEPARTMENT

STEVE McCALLEY, R.E.H.S.
DIRECTOR



2700 "M" Street, Suite 300
Bakersfield, CA 93301
(805) 861-3636
(805) 861-3429 FAX

April 20, 1993

TO: Ted James, Director
Planning and Development Services Department
ATTN: Benjamin Guerrero

FROM: Steve McCalley, Director *Roger Benetti*
Environmental Health Services Department

SUBJECT: EA 23-93; CUP #4, Map #115; CUP #8,
Map #115-35; Cup #9, Map #136

The design of the project or the type of improvement is not likely to cause serious public health problems. Therefore, this Department has no comments or recommendations and does not wish to impose any conditions on the subject project at this time.

SMc:RB:jg



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX

75 Hawthorne Street
San Francisco, Ca. 94105-3901

May 6, 1993

Dave Taylor
Bureau of Land Management
Ridgecrest Resource Area
300 S. Richmond Road
Ridgecrest, CA 93555

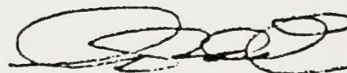
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We note that in March, 1993, we provided you with scoping comments for the Briggs Project, Inyo County, which appears to be quite similar to the Rand Project. Please consider our Briggs Project scoping comments as applicable to the Rand Project. For your convenience, we have enclosed a copy of our Briggs comments. The scope of subjects that should be addressed in the EIS includes water resources, air quality, vegetation and wildlife, mining waste and reclamation, and special status lands.

We appreciate the opportunity to comment on the proposed project and request one copy of the EIS when it is available. If you have any questions, please contact Jeanne Geselbracht at (415) 744-1576.

Sincerely,



For J.W.

Jacqueline Wyland, Chief
Office of Federal Activities

Enclosure

cc: ✓ Kern County Dept. of Planning and Development Services
Kern County APCD

General Comments

Data on the potential adverse impacts of open-pit mining and heap-leach mining and techniques for mitigating these effects have improved in recent years, although uncertainty remains regarding the long-term effects of land disturbance, mining wastes, groundwater withdrawals, and other products of mining activities. We believe that the Environmental Impact Statement (EIS) for the proposed project should build upon this knowledge to demonstrate that all reasonable alternatives to proposed actions have been thoroughly considered and incorporated into the project. The EIS should provide substantial detail on the means of implementing mitigation measures, and should also identify how monitoring will be set up to ensure compliance and assess effectiveness of mitigation.

Water Resources

1. For each alternative the EIS should discuss the project's compliance with state-adopted, EPA-approved water quality standards. The project planning should be fully coordinated with the California Regional Water Quality Control Board-Lahontan Region to ensure that water quality is protected and beneficial uses are maintained. If the project would require discharges to creeks in the area, the EIS should address the potential effects on water quality, such as thermal changes and increased toxicity and salinity. The effects of such impacts on designated beneficial uses of the streams should be thoroughly considered.

2. Completely describe the original (natural) drainage patterns in the project locale, as well as the drainage patterns of the area during project operations and following reclamation. Include hydrologic and topographic maps of the area. This discussion should encompass effects of the project on erosion potential and sedimentation.

a. Identify whether any components of the proposed project would fall within the 100-year (24 hour storm) flood plain. Discuss the potential for flash floods to transport sediment from disturbed areas to stream channels.

b. Discuss the potential for contamination of surface flows (perennial or from storm events) and rainfall which pass may through tailings disposal facilities or waste rock dumps. Describe mitigation measures to prevent this contamination, including construction of run-on/run-off channels, impermeable covers, and any collection or sedimentation ponds. What provisions would be made for post-operation

surveillance to ensure that stabilization of mining waste sites has been effective? Describe the mitigation actions that would be taken should destabilization be detected and identify who would be responsible for these actions.

3. Discuss how accidental releases of hazardous materials, including overflow from ponds would be handled. Identify the potential impacts resulting from failure of components of the solution containment systems and tailings ponds, and the degree to which impacts would be reversible.

4. EPA regards the use, recycling, and final disposition of cyanide in mining as one of the most problematic and controversial aspects of heap leach operations. The behavior of cyanide in soils and groundwater is complex. Discuss the potential for release of cyanide or other contaminants into the soil and groundwater. The EIS should describe how the toxicity of cyanide would be controlled or eliminated during use in processing, and should discuss the environmental fate of cyanides after use in mine processes.

Cyanide may be more persistent in some environments than would be predicted based on general knowledge of attenuation. This may be the result of a reducing environment or cyanide forming complexes with heavy metals. The EIS should describe the predicted chemistry of cyanide in water and soil at the proposed project site, and the cyanide budget resulting from heap leach processing at similar mines. The discussion should identify the composition and toxicity of cyanide compounds present in waste sites such as tailings impoundments; discuss the potential for cyanide compounds to migrate into surface waters and groundwater, and to decompose to free cyanide; and explain any processes used to destroy cyanide.

5. The EIS should enumerate water sources and estimate rates of water use by the proposed project operations as well as current operations and other related projects. Identify any impacts to wetlands, vegetation and wildlife, and other groundwater-dependent resources as a result of groundwater pumping associated with the proposed project. (See "Vegetation and Wildlife," page 3).

6. Discuss the acid generation/neutralization potential for waste rock, tailings, and pit walls at the site. Describe the leach tests to be conducted on ore and waste rock and provide the results for each test. Describe the quality of waters at any mining sites nearby, particularly older mines, that may be used to predict future acid generation at the Briggs site. Describe and commit to measures to prevent acid generation and any

mitigation measures that may be necessary should prevention measures fail.

7. Provide projected chemical characterization of water in open ponds located at the site, including projected water quality in any open pits following closure.

8. Describe in detail the proposed facility design and operation, including liner and cover specifications, ditches and ponds, and maintenance and monitoring activities to insure integrity of facilities throughout project operations and closure.

9. Describe the locations of all monitoring wells, vadose zone monitoring devices (e.g., suction lysimeters), and points of compliance on the site. The screening intervals, parameters to be monitored, and monitoring frequencies should be discussed.

10. Consult with the U.S. Army Corps of Engineers to determine if the proposed project requires a Section 404 permit under the Clean Water Act. Section 404 regulates the discharge of dredged or fill material into waters of the United States, including wetlands and other "special aquatic sites."

If a permit is required, EPA will review the project for compliance with Federal Guidelines for Specification of Disposal Sites for Dredged or Fill Materials (40 CFR 230), promulgated pursuant to Section 404(b)(1) of the Clean Water Act.

Air quality

1. Discuss the attainment status of the area for priority pollutants. Discuss the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments applicable to air quality in the project area. PSD increments exist for sulfur dioxide, total suspended particulates, and oxides of nitrogen. Discuss impacts to the NAAQS and PSD increments from estimated emissions, considering the cumulative effects from all aspects of mine excavation, construction, operation, and support activities, such as vehicle traffic. BLM should closely coordinate with the Great Basin Unified Air Pollution Control District.

2. PSD increments are highly protective of air quality in Class I areas such as wildernesses and national parks. The PSD increments for total suspended particulates are 5 ug/m³ (annual) and 10 ug/m³ (24-hour). The EIS should identify any Class I areas within at least 100 kilometers of the project site. Class I areas even further away could potentially be affected as well.

BLM should consult with the National Park Service and the U.S. Forest Service for a determination of which areas could be adversely affected by the proposed action. Potential impacts to Class I PSD areas, including visibility impacts, should be discussed.

3. Discuss any mitigation measures necessary to comply with NAAQS, PSD, and the State Implementation Plan (SIP).

4. Discuss the applicability and requirements of the New Source Performance Standards for Metallic Mineral Processing Plants (40 CFR part 60.380-386) with respect to the proposed project.

5. The EIS should discuss the possibility of an air quality monitoring program which would be implemented to ensure project compliance with all applicable air quality standards and permits.

Vegetation and wildlife

1. Poisoning of animals attracted to waters containing cyanide has been an extremely serious problem with heap leach operations. Discuss the mitigation measures which would be taken to prevent exposure of migratory waterfowl and other wildlife to any toxic waters used in or resulting from processing the ore. Identify how solution impoundments and ditches would be treated to prevent poisonings. Netting and scare tactics are not completely reliable prevention measures. We recommend that serious consideration be given to covering all cyanide solutions on the project site.

2. BLM should work closely with the U.S. Fish and Wildlife Service and the California Department of Fish and Game to determine potential impacts of the project on plant and wildlife species, especially species classified as rare, threatened, endangered, or candidate species on either state or federal lists.

3. The EIS should discuss avoidance, minimization, and mitigation of losses or modification of habitat and plant and animal species composition.

Resource Conservation and Recovery Act

1. The EIS should address whether the "Bevill rulings" to the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, are applicable to any activities or processes at the project site. For the rulings, please refer to the following citations:

40 CFR Part 261, Mining Waste Exclusion; Final Rule, Federal Register vol. 54, No. 169, September 1, 1989;

o 40 CFR Parts 260, 261, 262, Mining Waste Exclusion and Definition of Designated Facility; Proposed Rule, Federal Register vol. 54, No. 184, September 25, 1989;

o 40 CFR Parts 260, 261, 262, Mining Waste Exclusion; Section 3010 Notification for Mineral Processing Facilities; Designated Facility Definition; Standards Applicable to Generators of Hazardous Waste; Final Rule, Federal Register vol. 55, No. 15, January 23, 1990.

The EIS should also discuss any measures to be taken at the project site to ensure compliance with applicable RCRA regulations.

Mining Waste Management and Land Reclamation

1. The EIS should discuss the following components of waste management and reclamation plans: (a) a detailed account of measures taken to decommission mine operations, stabilize slopes, and neutralize or cap waste rock, tailings, and leach heaps; (b) identification (including estimated acreages) of the areas targeted for reclamation, and clarification of the intended degree of treatment in each area; (c) estimation of any irrigation requirements; (d) timing of reclamation relative to mining operations and duration of reclamation treatment; (e) standards for determining and means of assuring successful reclamation; and (f) means of assuring that any maintenance required for reclaimed areas would continue after operations cease or while operations are suspended. We recommend that the reclamation plan be coordinated with a site-specific closure plan.

2. The EIS should specify the level of bonding appropriate to the intended scale and quality of reclamation and mining waste management. Also identify who would be responsible for any post-closure cleanup actions should they be necessary.

Special Status Lands

The EIS should discuss the proposed project's potential impacts to the California Desert Conservation Area, any wilderness study areas (WSA), or proposed wilderness areas under S. 21 and H.R. 518 (the California Desert Protection Act). Congress is expected to pass the Act some time this year. If the proposed project is located within a WSA or designated wilderness, BLM must manage the land so as not to impair or

degrade its wilderness values; and the EIS should discuss how this would be accomplished.

Cumulative Impacts

The EIS should address potential cumulative impacts to resources, considering the proposed project in the context of past, current, and reasonably foreseeable future mining and other activities in the project vicinity. The analysis should include a discussion of impacts to water and air quality, hydrology, soils, vegetation, wildlife, and biodiversity.

COUNTY INTER-OFFICE MEMORANDUM

ROY ASHBURN
SUPERVISOR, FIRST DISTRICT

TO : Department of Planning and Development Services
Attention: Jim Ellis

FROM : SUPERVISOR ROY ASHBURN
By: Donna Darnell, Assistant

DATE : May 7, 1993

SUBJECT: Rand Mining expansion

Attached is a letter requesting that the county address the concerns of the Rand Communities Water district regarding possible impacts to the aquifer from which they serve their customers as a result of the Rand Mine activities.

Attached is our draft response simply saying we are forwarding their request to you. Please handle appropriately.

Thanks.

Scott
please be sure this
concern re. Rand II
is addressed.

je 5/12

103 MAY 12 11:03

RAND COMMUNITIES WATER DISTRICT

P.O. BOX 198
RANDSBURG, CALIFORNIA 93554
(619) 374-2414

May 4, 1993

Mr. Roy Ashburn
China Lake Blvd.
Ridgecrest, Ca. 93555

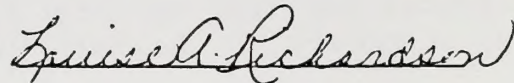
Re: Rand Mining Company
Rand Project
EIS/EIR

Dear Mr. Roy Ashburn

This letter is to request that the Environmental Impact Study presently being conducted by EMA, Inc., address the issue of the increased and prolonged use of water from the aquifer from which the Rand Communities Water District draws its water.

Your immediate attention to this matter is greatly appreciated.

Very Truly Yours,



LOUISE A. RICHARDSON
President, Rand Communities
Water Board

LAR: cp

CC: Mr. Taylor

May 7, 1993

Louise A Richardson, President
Rand Communities Water Board
P.O. Box 198
Randsburg, CA 93554

Dear Mrs. Richardson:

Thank you for sending me the district's request that the Environmental Impact Study for the Rand Mining Company expansion appropriately address impacts to the aquifer as the result of any increased need for water.

I am forwarding your request to the County Department of Planning and Development Services which is acting as lead agency for the proposed expansion.

Thank you for permitting me to be of assistance.

Best regards,

Roy Ashburn



1350 Norris Road
Bakersfield, California 93308-2231

MAY 8, 1993

Department of Planning and Development Services
2700 "M" Street, Suite 100
Bakersfield, CA 93301

Attention: Benjamin Guerrero

Subject: EA 23-93; CUP #4, Map #115; CUP #8, Map #115-35; CUP #9, Map #136
(Randsburg Mining Company)

On Friday, May 7, 1993, I toured the facilities of the Rand Mining Company at Randsburg. In my discussions with the General Manager, Steve Stillar, and the Mine Superintendent, Steve Baumann, all my concerns were addressed. I was impressed by the professionalism of these two gentlemen and of the operation in general.

I was impressed by the efforts the Rand Mining Company has made to ensure that there will be as little impact as possible on the local community and those who will view the project from the highway. All equipment is kept out of sight from roads and the operation in general is very clean and neat. The precautions the company has taken to ensure that all ecological concerns have been addressed were fully explained.

During our conversation we also discussed security, both theft and perimeter. The entire site is fenced and signed and a roving patrol is maintained on a random basis. Trespassers are not a problem due to the clearly marked boundaries and signs. There are currently employees on site 24 hours a day, 7 days a week.

In the matter of the theft of gold, due to the manner in which the ore is processed, there is virtually no opportunity for theft. The finished product is sold to the refiner on site and is removed in an armored car by the refiner.

It is my conclusion that this project will have little impact on the operations of the Kern County Sheriff's Department in the Ridgecrest Substation area.

F. L. Ross

Fredrick L. Ross, Commander
Northeast Substation Area

COUNTY OF KERN
RESOURCE MANAGEMENT AGENCY
TRANSPORTATION MANAGEMENT DEPARTMENT
Office Memorandum

TO : Ted James, Director
Planning & Development Services
Attn: Environmental Analysis Section
FROM : Fred Simon, Principal Planner
Transportation Management Department

DATE: May 5, 1993

PHONE: 2481

SUBJECT : 7-5.3 Notice of Preparation of a Draft Environmental Impact Report for EA 23-93;
Conditional Use Permit #4, Map #115; Conditional Use Permit #8, Map
#115-35; Conditional Use Permit #9, Map #136; Both Sides Red Mountain
Road, South and West from Randsburg (Rand Mining Company)

This Department has reviewed the Notice of Preparation for the above referenced Conditional Use Permits to allow the expansion of four existing mining operations and recommends that the DEIR consider the potential impacts to movement of vehicles onto and off of the project site from County roads. As a mitigation measure, we recommend that all new access openings onto County maintained roads shall be constructed to County standards under encroachment permit issued by the Transportation Management Department. The location(s) of these private road approaches shall be as approved by Planning and Development Services and Transportation Management Department.

Should you have any questions regarding these comments, please feel free to contact Don Turkal of the this Department.

FS:ab
M25.D51

COPIED TO FILE
MAY 11 1993

04/29/93

Project: KER.RAND MINNG
SCH No.: 93042054
Location: RANDSBURG

1. Is sufficient information available
to enable review? (X) Yes () No
2. Could the project have adverse effects on fish, wildlife,
or native plants? (X) Yes () No () Maybe
3. Could the project restrict the range or reduce the
numbers of a rare or endangered species? (X) Yes () No () Maybe
4. Will included mitigation reduce project impacts below
significant levels? () Yes () No (X) Maybe
5. What (if any) additional mitigation should be required?
None
6. Do unavoidable project impacts warrant preparation
of an EIR? () Yes () No (X) Maybe
7. Could the project change the bed, bank or channel
of a stream or lake? (Is DFG notification required?
(Fish and Game Code section 1601-03?)) () Yes (X) No
8. Additional Comments:

SEE ATTACHMENT
These comments may be revised if new information becomes available.
9. Is the project subject to Environmental Filing
Fees (Fish and Game Code section 711.4)?

(X) Yes (Explanation Attached)
() No (Exemption Attached)

DFG Contact: DR. JEFFREY R. SINGLE
Telephone: (209) 445-6152

Regional Manager

8. DEPARTMENT WILL BE IN DIRECT CONSULTATION WITH APPLICANT WITH RESPECT TO MODIFICATION OF EXISTING PERMITS, AND CONTENT OF THE EIR/EIS. STAFF ARE AVAILABLE FOR COUNTY CONSULTATION, AS WELL

INFORMATION ABOUT
ENVIRONMENTAL FILING FEES

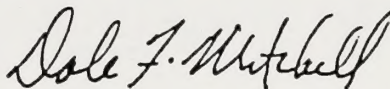
We believe the proposed project has associated incremental impacts which will have an adverse, although minor, effect upon fish, wildlife or native plants. In this case, the project has been proposed in a manner and/or location which reduces its incremental impacts such that we believe an EIR for the project is not warranted.

From a cumulative standpoint, however, the Lead Agency should recognize that even minor levels of disturbance or habitat loss can become significant if they are more broadly replicated through successive and permanent land use changes. While it is our position that the cumulative changes associated with this project may not be significant enough to warrant serious analysis (an EIR) or specific mitigation at this time, the significance of those cumulative effects could change in the future depending upon the number and scope of other projects approved within the geographic area.

Regardless of whether the above project will incrementally have environmental effects which were determined to exceed the CEQA "significant impact" threshold, (therefore warranting specific or general mitigation measures and/or preparation of an Environmental Impact Report), we believe the project will involve elimination or destruction of at least some habitat. For this reason, the project is not considered by the Department as "De Minimis" with respect to Fish and Game Code Section 711.4. As such, we believe the project is subject to the Environmental Filing Fees, as therein described. If a Negative Declaration will be filed by the County pursuant to Public Resources Code Section 21080(c), the fee will be \$1250, payable to the County Clerk when the Notice of Determination is filed.

In the event the project or its associated information basis is changed, we request an opportunity to reconsider these comments. If you have questions or wish to discuss these comments, please contact me at the above address or telephone number.

Sincerely,



Mr. Dale Mitchell
Environmental Specialist IV Supervisor

California Communities Against Toxics

The Ward Valley Coalition

The Desert Rebellion Coalition

Don't Waste the Desert

Southern Kern Residents Against Pollution

Desert Citizens Against Pollution

3813 50th Street West, Rosamond, Ca. 93560

phone 805 256 2101

fax 805 256 0674

May 14, 1993

To Kern County Planning Dept
Bakersfield, Ca.

COMMENTS REGARDING THE APPLICATION FOR A CONDITIONAL USE PERMIT
FOR THE RAND PROJECT OF RAND MINING CO. RANDSBURG, CA.

My name is Stormy Williams and I have been a resident of Rosamond Ca. in Kern County for 37 years. I have been working on the clean up of the 24 toxic sites in Rosamond for several years and also on the National Cement plant near Gorman because they are incinerating hazardous waste there. I also work with many other desert groups and other groups around the state on their toxic problems. I am the Desert Rep. for a large Coalition called California Communities Against Toxics and so on. I am covering all the environmental problems in the desert. I have a vocational agronomy degree from UC Davis which helps me understand soils, insects, animals and plant problems related to these toxic matters.

I live near 2 heap leach gold mines and I don't think they are very good neighbors.

The big problem is particulate emissions from the blasting operations and the dirt roads around and in the mine. At times blasting has caused particulate emissions many of hundreds of feet into the air. This is very unhealthy to humans and animals. I notice in the document that there is a residence $\frac{1}{2}$ mile from this mine. It is mentioned that PM_{10} is the main pollutant of concern and that high winds or increased surface disturbance could elevate these emissions. Since there is only 1 air pollution control person assigned to our desert APCD I know they will not be able to be at this site often. Therefore it should be very plain in writing regarding permitted emission levels. Also there will be a large area of disturbed ground that will contribute to this particulate emission problem. It should be in writing how much water and coating will have to be used to control this dust. If left up to the judgement of the operator it may not be applied often enough or in proper amounts. The persons living $\frac{1}{2}$ mile away need special protection and they should be able to call the desert APCD toll free anytime of the day or night if there is a problem.

Another concern regarding air emissions is mercury. In a mine here there is mercury in the ore and the equipment used to filter it out of the refining process broke down. There was mercury everywhere including pools on the ground and in the air. There had to be a variance on the retort machine until they could get it working properly. This was very upsetting to the neighbors of the mine. Will there be any mercury problems in this operation? If so this matter needs to be included in the permit as to how it will be handled.

Another problem is the vibrations caused by the blasting. These blasts can shake houses and wells and have caused problems in our area. Wells can become silted and cost the owners a lot of money to fix. The public should not have to live in fear that their windows are going to crack and their wells will be ruined. Something should be put into the permit restricting the size of the blasts so this damage cannot happen.

Regarding the actual cyanide heap leach operation. All plastic liners leak (see attachment re. liners). We are very worried about the affect this has on the underground water. The cyanide is a grave concern as it is very toxic and dangerous to humans and animals. I see the cyanide being sprayed over the mines here and it blows everywhere. You can smell it on the Antelope Valley freeway coming off the Billington mine south of Mojave. It is better to use tanks for the cyanide process and forget the heaps. The heaps will be in place forever and you have the plastic degrading with time. There is also the chemicals needed to neutralize the heap which also present problems. The tanks can be used for the length of time of the project and then they can be removed and sold. There would be no contamination of the air, land or water of cyanide. This is being done at the Viceroy Mine East of Barstow so this operation could be used as a model to look at.

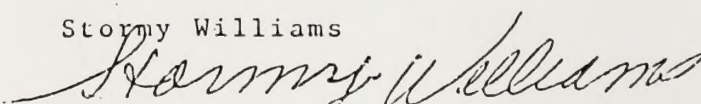
I noticed in the document there is a mention of bird netting across the cyanide pits. This may help some if you have cyanide pits but it won't control the small animals who die from these operations. I am also worried about the bats which are mentioned. You may have problems with bats getting thru or trying to get thru the netting. Some agency needs to be in charge of checking on the animals and birds affected by this operation. Self reporting is not working regarding these problems.

TANKS FOR THE CYANIDE OPERATION WOULD SOLVE ALL THESE PROBLEMS.

I am very concerned about the plant and animal populations disturbed by this enormous operation. 1,000 acres is a lot of area to be affected by this mine. We would have many native plants and small animals in danger including the desert tortoise. These animals do not do well when moved, that has been proven. More study needs to be done on this problem. Also I see mentioned, transplanting joshua trees and cactus. I know these plants are hard to move and the document doesn't go into any detail on these transplanting procedures. Transplanting these species in the hot weather will not work well and a timetable for these activities needs to be done. Creosote bushes are also mentioned for transplanting and I believe small ones transplant well but I am skeptical of survival of the mature plants. Are there any studies about all this? These important reclamation details need to be positively in the permit and not left to the discretion of the operator.

This massive project certainly will disturb hugh amounts of land and use hugh amounts of water, 500,000 gal. per day. On the whole these mines are destructive and are environmental disaster areas. I'd like to see this mine scaled down so there wouldn't be so much disturbance to the land, plants and animals.

Stormy Williams



ANALYZING WHY ALL LANDFILLS LEAK

The U.S. Environmental Protection Agency (EPA) has paid for a series of engineering studies to find out the best way to make a landfill. They wanted to know what was the "best demonstrated available technology" (BDAT) for making landfills. These studies reach some surprising conclusions.

Landfills are bathtubs in the ground; the bottom of the bathtub is called a liner and it can be made of compacted clay soil, or it can be made of a huge sheet of plastic underlain by ordinary soil, or it can be a huge sheet of plastic underlain by a layer of compacted soil (usually clay soil). The third combination, plastic liner and compacted soil, is called a "composite liner." (A composite liner is not a double liner; it is a single liner made up of two parts; to create a double liner, you would use two composite soil liners together, separated by a layer of sand or gravel.) Geoservices did not examine the second type of liner (plastic sheet on ordinary soil) because ordinary soil provides poor support for a plastic liner carrying many tons of weight, so they restricted their analysis to compacted clay liners vs. composite liners.

The EPA wanted to know which liners were the best ones available: compacted clay liners, or composite soil liners? So they hired Geoservices (of Boyton, Florida) to tell them. The resulting study makes dull reading because it is filled with technical details, but the conclusions are fascinating. *All liners perform worse than anyone suspected.*

Clay liners

Geoservices didn't have much good to say about clay liners. The flow of liquids through a liner (the liner's permeability) is measured in centimeters per second (cm/s). The EPA's current requirement for a liner for a hazardous waste landfill is that it pass liquids through it no faster than 10^{-7} cm/s (read ten to the minus seven centimeters per second, or one ten millionth of a centimeter per second). However, based on actual experience in the field, Geoser

vices concludes that this ideal permeability is often not achieved for a variety of reasons. (See pgs. 3-3 through 3-8; case studies of clay liners appear in Appendix A.) Therefore, they assume that the actual permeability in the real world lies between 10^{-7} and 10^{-6} cm/s. Geoservices concludes, "Possibly the most significant observation is that with compacted [clay] soil bottom liners, leakage out of the [landfill] will be large (if there is leakage through the top liner).... even in [landfills] meeting current EPA design requirements" including permeability of 10^{-7} cm/s (pg. 3-18). By "large" leakage, Geoservices means 90 gallons of fluid leaking through each acre each day, or 900 gallons per day leaking from a 10-acre landfill. Their calculations show that, with 3 inches of water standing on the bottom liner, it will take 15 years for leakage to break through a 3-foot-thick compacted clay bottom liner, but once breakthrough has occurred, 90 gallons per acre per day will pass through the liner continuously thereafter. (See pg. 3-16, and Table 3-3 on pg. 3-40.) It won't take very long to contaminate a large drinking water supply if you pour 90 to 900 gallons of toxics into it day after day, year after year. Thus Geoservices has shown that clay liners are an environmental disaster.

Composite liners

Geoservices reports that all plastic liners (also called Flexible Membrane Liners, or FMLs) always have some leaks. "A common misconception regarding FMLs is that they are impermeable, that is, no fluid will pass through an intact FML. However, it is important to realize that all materials used as liners are at least slightly permeable to liquids or gases and a certain amount of permeation through liners should be expected. Additional leakage results from defects such as cracks, holes, and faulty seams." (pg. 4-2)

FMLs often develop defects called "pinholes" during manufacture; these result from thin places ("fish eyes"), bubbles, foreign material, or lumps of carbon in the raw molten plastic from which the FML is rolled ("calendered") into sheets. Furthermore, when a large landfill liner is created

by joining strips of FML together with glue or by welding, the resulting seams often leak. Geoservices provides some data on typical seam defect rates. They look at six case studies (pgs. B-7 thru B-11). Based on the six case studies, they draw the following "tentative conclusions: "an average of one leak per 30 feet of seam can be expected if there is no quality assurance program (quality assurance being a third party coming along behind with special equipment to check the adequacy of the seams). Even with good quality assurance, "an average of one leak per 1000 feet of seam can be expected with reasonably good installation, adequate quality assurance, and repair of noted defects." (pg. B-11) That is to say, under the best of circumstances, you'll get one leak per thousand feet of seam. If the landfill liner is made by welding strips of FML that are each 20 to 30 feet wide, you can expect one to two defective seams in each acre of landfill.

Based on actual data, Geoservices concludes that a "standard" (typical) leak in an FML has an area of one square centimeter (1/16 of a square inch) and that the "standard" (average) number is one hole per acre. They point out that this "standard" hole size and standard number per acre are based on the assumption that "intensive quality assurance monitoring" will be performed during liner installation, so clearly we are talking about the best case, not the worst case here. Design flaws, poor construction practice, or poor quality assurance would result in larger holes, greater numbers of holes, or even large tears. (pg. B-13)

Geoservices then goes through an elaborate mathematical analysis to figure

out how much fluid will pass through a composite liner under the best possible conditions and under less ideal (but still optimistic) conditions. They conclude (pg. B-41) that the "best demonstrated available technology" (BDAT) for composite landfill liners will allow leakage rates somewhere between 0.02 and 1.0 gallons per acre per day. (See Table B-10 on pg. B-51.) Thus they conclude that a 10-acre landfill will have a leak rate somewhere between 0.2 and 10 gallons per day, or between 73 and 3650 gallons of fluid per year; over 10 years, such a landfill will allow the leaking of 730 to 36,500 gallons of fluid. And this is the "best demonstrated available technology"--the very best we can do when everything goes right.

Next week we will show that leaking 730 to 36,500 gallons of toxics into a water supply during a 10-year period guarantees destruction of the drinking water resource.

We will also show that the Geoservices study is unduly optimistic because, as they say themselves (pg. B-7), "Many types of FMLs swell when placed in contact with chemicals. As a result, the distance between polymeric chains increases and permeability increases. Therefore, an FML can have a low permeability for water and a high permeability for some chemicals."

If you're interested in technical details, get: Geoservices, Inc. Background Document on Bottom Liner Performance in Double-Lined Landfills and Surface Impoundments. Springfield, VA: National Technical Information Service, April, 1987. Order from National Technical Information Service, Springfield, VA 22161; phone (703) 487-4650. Order No. PB87-18229-1. \$36.95.

Rachel's Hazardous Waste News is published weekly by Environmental Research Foundation, P.O. Box 3541, Princeton, NJ 08543. The Foundation is non-profit; contributions are tax-deductible. Editor: Peter Montague, Ph.D.; Associate Editor: Maria B. Pellerano; Assistant Editor: Annette Eubank; West Coast Editor: Tim Montague. The News is mailed first class every Tuesday. Subscription: \$10 per year for individuals and non-profits, \$6 for students and senior citizens, \$150 for businesses. In Canada, add \$4.00; in Europe, add \$11.00.

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May 13, 1993

Barbara Rigg

5442 Backus Rd.

Mojave, Ca. 93501

Benjamin Guerrero

Kern County Planning

2700 N. Suite 100

Bakersfield, Ca. 93301

Dear Mr. Guerrero:

I am asking you to deny the permit to enlarge the 4 mines at Ransberg. We have enough problems here without adding more chemicals.

We live downwind of 2 mines close to us & 3 cement plants burning toxics. Please don't add any more.

We have respiratory problems & sinus irritation & infection. Many people are taking Seldene just to be able to function. Our heads feel

2.

Like the brain is swollen,
muscles hurt & we are stiff or
num especially in the early A.M.

Our bodies swell around the middle
as if our livers are irritated & it
makes it hard to breathe. Our feet
hurt to touch or walk, (on the bottom)
it lasts until the air clears up.

We lose our train of thought
frequently & have heart palpitation.
We also feel sick to our stomachs,
& our eyes have trouble focusing
when the sun is out or a fairly
bright light. Your gums hurt
& bleed but it doesn't last long.

"When we get any where there is dust,
that is most everywhere, we itch & turn
red. Then it burns your skin, not
like the sun but, ~~an~~ like an unnatural
heat.

We are not the only ones bothered.
Our animals have many of
the same problems at all ages.

Most people tell us they have
similar symptoms in varying
degrees. We have had more
illness by most this year.
Doctors don't know what as they
just aren't saying. They may
say you have allergies.

We don't have everything down
here but you have the picture
I'm sure. With our unpredictable
winds we have so many bad
chemicals now & they always
tell us everything is okay, nothing
will go that far but it all does
& we are tired of living with
in these conditions. Please
help us to be able to live a
normal life again

Thank you for your consideration.

Sincerely,

Barbara Rejo, Acting President
of the Ancient Valley Civic
Improvement Assn.

Ginda Finch
Gandi Finch
Mrs. Marges

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STATE OF CALIFORNIA - RESOURCES AGENCY

PETE WILSON, Governor

DEPARTMENT OF CONSERVATION
DIVISION OF MINES AND GEOLOGY
MINED-LAND RECLAMATION PROJECT
801 K STREET, MR 12-32
SACRAMENTO, CA 95814-3531
(916) 323-0687 PHONE
(916) 324-1399 FAX



June 22, 1993

Mr. Scott Denney
Kern County
Department of Planning and Development Services
2700 M Street, Suite 100
Bakersfield, CA 93301

Dear Mr. Denney:

Mining and Reclamation Plan for the Rand Project

The Mined-Land Reclamation Project staff of the Department of Conservation's Division of Mines and Geology (DMG) has reviewed the Mining and Reclamation Plan and Application for Conditional Use Permit for the Rand Project. The following comments, prepared by James Pompy, Kit Custis, and Karen Wiese, are offered to assist in your review of this project.

The Surface Mining and Reclamation Act of 1975 (SMARA) and the State Mining and Geology Board regulations for surface mining and reclamation practice (California Code of Regulations (CCR), Title 14, Chapter 8, Article 1, Sections 3500 et seq.) require that specific items be addressed or included in reclamation plans. For all reclamation plans approved or substantially amended after January 15, 1993, reclamation shall be in conformance with the recently enacted Article 9 Reclamation Standards (copies enclosed). The following items were either not included or not sufficiently addressed in the documents we reviewed.

Geotechnical Requirements

(Refer to CCR Sections 3502(b)(3), (b)(4), 3704 (a), (b), (d), (f))

1. CCR Section 3502(b)(3) requires that whenever the final slopes approach the critical gradient for the type of material mined, the regulatory agencies shall require an engineering analysis of the slope stability. The proposed final quarry configuration will have an overall slope of 1 horizontal to 1 vertical (1H:1V) for a maximum height of approximately 600 feet. However the intermediate bench slopes will be approximately 1/2H:1V. The overall angle and the intermediate angle of final slopes may approach the critical gradient for the materials being mined,

the stability of the slope. We recommend that a preliminary geotechnical engineering stability analysis be prepared for the pit slopes to evaluate the long-term stability of the final slopes. We also recommend periodic inspections of the stability of the quarry highwalls. If the quarry highwalls show evidence of mass instability, additional engineering analysis of the stability should be performed. This analysis should demonstrate that the final slopes will have a factor of safety sufficient to ensure long term stability.

The reclamation plan indicates that the final waste rock fill slopes will be approximately 350 feet high. Figure 4 of the reclamation plan indicates that the final slopes for the waste rock stockpiles will have an overall slope of 2H:1V with bench slopes of approximately 1/2H:1V (± 60 degrees). While the overall angle of 2H:1V is generally considered stable, the 60 degree bench slope angle probably exceeds the critical gradient for loosely placed fill material. We recommend that a stability analysis be performed to demonstrate the long-term stability of the waste rock fills.

Hydrology and Water Quality

(Refer to SMARA Sections 2772(h)(1),(h)(2), 2773(a), CCR Sections 3503(a)(3),(b)(1),(d), 3706(c),(d),(e),(f),(g), 3710 (b),(c), 3711(e), 3712)

2. CCR Section 3706 requires that erosion and sedimentation be controlled during all phases of mining and reclamation, and provides performance standards for drainage, diversion structures, waterways, and erosion control. The reclamation plan indicates that the final drainage and erosion control plan will be developed at a later date as part of the Report of Waste Discharge to the Regional Water Quality Control Board. The information submitted to the Regional Board may include a Storm Water Pollution Prevention Plan. Information on erosion and sedimentation control, maintenance, and monitoring contained in the Report of Waste Discharge and the Storm Water Pollution Prevention Plan may meet the requirements of SMARA. We recommend that with the Storm Water Pollution Prevention Plan requirements be incorporated into the reclamation plan. If additional information, such as long-term erosion sedimentation control during reclamation, are necessary they should be provided.

Environmental Setting and
Protection of Fish and Wildlife Habitat

(Refer to CCR Sections 3502(b)(1), 3503(c), 3703 (a), (b), (c), 3704(g),
3705(a), 3706(a), (f), (g), 3710(a), (b), (c), (d), 3713(b))

3. CCR Section 3502 (b)(1) requires that the reclamation plan include a description of the environmental setting of the mine site. A full description of the site is necessary for the following three reasons: 1) to document baseline conditions, 2) to aid in development and evaluation of an appropriate revegetation plan, and 3) to evaluate purported mining and reclamation impacts on wildlife habitat.

Prior to site disturbance, a quantitative description of the biotic setting of the site will be necessary to adequately establish baseline conditions of the site. This quantitative evaluation should include percent cover or density, and diversity measurements for each of the vegetation types that will be established on the reclaimed landform. Such quantitative data can also be used to guide the design of an appropriate revegetation plan.

Also, prior to any site disturbance, the purported lack of impacts to sensitive, rare, threatened, and endangered plants and animals should be verified. The revegetation of the site should be designed to help lessen impacts to unique species. Without the knowledge of which species occur on the site, the revegetation design cannot target those species. The reclamation plan refers to several sensitive species, but does not indicate the source of this information nor whether a survey was performed. We recommend that the biological information be supplemented to include spring surveys for plants, and resident and migratory wildlife during the appropriate seasons. We also recommend that the California Department of Fish and Game and the U.S. Fish and Wildlife Service be contacted to develop guidelines for habitat restoration for these species.

The following sensitive species have been reported from the project and vicinity:

Desert tortoise (<u>Xerobates agassizii</u>)	State: Threatened Federal: Threatened BLM: Sensitive
Mohave ground squirrel (<u>Spermophilus mohavensis</u>)	State: Threatened
Townsend's western big-eared bat (<u>Plecotus townsendii townsendii</u>)	State: Special Concern
Panamint kangaroo rat	State: Special Concern

(<u>Dipodomys panamintensis</u>)	BLM:	Sensitive
Prairie falcon (<u>Falco mexicanus</u>)	State:	Special Concern
La Conte's thrasher (<u>Toxostoma lecontei</u>).	State:	Special Concern

We recommend that the reclamation plan describe specific measures to avoid or offset impacts to all sensitive species on site, not only those listed by the State or Federal government as Threatened or Endangered. California Species of Special Concern and California Native Plant Society List 1B and List 2 species meet the criteria for listing by the State as Threatened or Endangered, and must be addressed under CEQA.

- CCR Section 3503(c) states that all reasonable measures be taken to protect the habitat of fish and wildlife. Attachment E of the Application for Conditional Use Permit states that "the solution ditches would not be covered." We recommend that the solution ditches be adequately maintained to prevent adverse impacts to wildlife. The California Department of Fish and Game and the U.S. Fish and Wildlife should be contacted to review strategies for wildlife protection.

Rezeiling and Revegetation

(Refer to SMARA Section 2773(a), CCR Sections 3503(a)(1),(2),(g), 3704(c), 3705(a),(b),(c),(d),(e),(f),(g),(h),(i),(j),(k),(l),(m), 3707(b),(d), 3711(a),(b),(c),(d),(e))

- SMARA Section 2772 (h) requires a description of the manner in which reclamation, adequate for the proposed use or potential uses will be accomplished. The reclamation plan states that "the pits would be reclaimed under the Level One guideline..." The "Level One" guideline is defined as "no reclamation activity other than to protect the public, livestock and range wildlife." Since the pits constitute a significant area, we recommend that the level of reclamation be increased to "Level Two" which will reclaim the site to be more compatible with the proposed end uses. Unless otherwise proven by test plots, a "Level One" reclamation activity, where no vegetation is re-established, could result in erosion, slope instability, loss of topsoil, and no habitat value for wildlife.
- CCR Section 3705(e) addresses the need for a soil analysis if the soil is altered or other than native. The reclamation plan states that "soil amendments may be

applied..." We recommend that soil amendments only be applied if a soil analysis determines the soil unsuitable for native plant establishment. We further recommend that fertilizer not be applied for the following reasons: 1) fertilizer inhibits the growth of beneficial soil symbiont, 2) fertilizer promotes the proliferation of weedy, non-native species over native species, and 3) fertilizer can enter ground and surface water creating potential contamination.

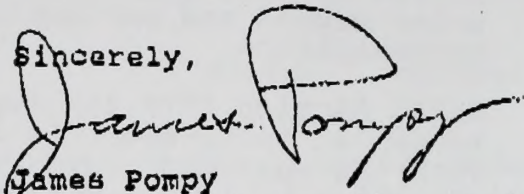
7. SMARA Section 2773 (a) requires that the reclamation plan establish "site-specific criteria for evaluating compliance with the approved reclamation plan, including topography, revegetation, and sediment and erosion control." The reclamation plan states that "monitoring of vegetation success...is expected to account for an additional two (2) to four (4) years" and that "monitoring would be conducted on a bi-annual basis" for six years. We recommend that monitoring be conducted annually until the performance standards (35 percent cover or more of the perennial shrub and herbaceous vegetation) are met. Annual inspections allow for the incorporation of remedial measures and a defined monitoring period may not be adequate to assess the success of revegetation.
8. CCR Section 3705(b) requires test plots to be conducted simultaneously with mining to determine the most appropriate planting procedures. The reclamation plan states that "Rand would transplant all Joshua trees, Golden cholla and Beavertail." Studies have shown that Joshua trees less than three feet in height do not survive transplantation. Greatest transplantation success has occurred when using non-articulated trees between four feet and ten feet in height (personal communication, Robert Moon, Joshua Tree National Monument). We recommend that test plots be conducted to test the feasibility of the proposed revegetation methods before costly mistakes are made. We also recommend that the reclamation plan be revised to address transplantation criteria for the Joshua trees.

The reclamation plan further states that "Rand would try to avoid the removal of Joshua trees, Golden cholla and Beavertail during construction..." For plants that are to remain on site, we recommend that flagging or brightly-colored fencing be used to limit construction activities in the vicinity of the plants. The placement of brightly colored plastic construction fencing at the dripline of each plant or around stands of trees is an effective method of protecting the crown and root zone of plants from mining activities.

OFFICE OF MINES & GEOLOGY TEL: 916-323-8565
Scott Denney
Page 6

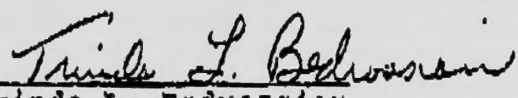
If you have any questions on these comments or require any assistance with other mine reclamation issues, please contact me at (916) 323-8565.

Sincerely,


James Pompy
Mined-land Reclamation Project
Manager

Concur:

6-22-93


Dated: Trinda L. Bedrossian
Supervising Geologist
RG 3363, CEG 1064

Enclosure

APPENDIX C

**Rand Mine Expansion Project Soil
Resources Inventory, Randsburg, California**

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**RAND MINE EXPANSION PROJECT
SOIL RESOURCES INVENTORY
RANDSBURG, CALIFORNIA**

Prepared for

RAND MINING COMPANY

By

EARL B. ALEXANDER, PH.D.

**KELLEY & ASSOCIATES ENVIRONMENTAL SCIENCES, INC.
216 F STREET, #51
DAVIS, CA 95616
TEL: 916-753-1232 • FAX: 916-753-2935**

JUNE 1993



**SOIL RESOURCES INVENTORY
RAND PROJECT EXPANSION
RAND MINING COMPANY**

PREPARED BY
EARL B. ALEXANDER, PH.D.
SOIL SCIENTIST
KELLEY & ASSOCIATES ENVIRONMENTAL SCIENCES, INC.

This soil resources inventory was prepared to help provide a means of effective assessment of the landscape impacts of proposed mining activities and for planning subsequent land and vegetation rehabilitation or restoration. Land reclamation following disturbance will allow the delay of runoff of storm water and support the re-establishment of an adequate cover of native plants. This soil resources inventory was designed to allow the prediction of responses to various land management techniques.

Infiltration rates, coarse fragment contents, and surface soil texture are factors assessed in the prediction of soil erosion rates and estimation of the extent of vegetative cover required to reduce erosion rates to tolerable limits. Soil fertility and physical constraints of the soil should be considered when choosing plant species for restoration efforts and when making fertilizer application recommendations.

Soils were mapped and described in this soil resources inventory. The soil descriptions incorporated into this inventory include all soil properties pertinent to appropriate interpretations of soil capability for land rehabilitation or restoration and the re-establishment of vegetation.

SCOPE OF THE SOIL RESOURCES INVENTORY

Soils were observed in roadcuts and hand-dug pits throughout the 2520-acre area. Soil-landscape units identified on stereographic pairs of color aerial photographs from a January 20, 1993, flight were delineated on 1:7,200 (1 inch = 600 feet) contour maps. The landforms and soils in these delineations are described in the section on map unit descriptions. The pedon descriptions (each from a different, representative location) incorporated in this report represent all of the major soils. These descriptions have the soils data required to design land rehabilitation and restoration projects.

KELLEY & ASSOCIATES ENVIRONMENTAL SCIENCES, INC.
Consultation and Restoration Services in Earth, Environmental, and Agricultural Sciences
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ENVIRONMENTAL SETTING

The inventory area is in the Rand Mountains of the Mojave desert. It is in a mountainous portion of the Basin and Range Province.

Landforms

The broad landforms of the area grade from mountains to hills to dissected pediments to floodplains, from higher to lower parts of the landscape. The highest point is 4741 feet and the lowest about 3200 feet above sea level. Floodplains are the most distinct landforms, but they grade onto pediments with indistinct margins in many places. The floodplain deposits, at least those on the south side of the Rand Mountains, are generally less than 3 meters thick over bedrock. Alluvial fans and basins are extensive at lower elevations, but not in the inventoried area.

It was sufficient to differentiate only two categories of bedrock. Most extensive is the Rand Schist and related metamorphic rocks (Hulin, 1925). The soils were different in areas with granitic rocks that weather to grus, a sugar-like saprolite. These rocks were identified as the Atolia quartz monzonite by Hulin (1925).

The slopes are much steeper on the north than on the south side of the Rand Mountains. This might be a direct or an indirect result of tectonic displacement, or it might be due to slope aspect differences in weathering and erosion. One of the consequences that is important in the soil resource inventory is that soils on pediments on the north side have a higher percentage of rock fragments.

Climate

Long-term weather records from Randsburg indicate that the mean annual temperature is about 63°F and the mean annual precipitation is about 6.6 inches per year. The mean monthly temperatures range from 45°F in January to 84°F in July. The mean monthly precipitation ranges from about 1.3 inches in February (and March) to 0.01 inches in June. We found no wind records from Randsburg.

Winter storms, responsible for most of the annual precipitation, approach from the west. Moisture from the south is responsible for a late summer increase in precipitation.

Vegetation

Desert shrubs dominate all plant communities. Joshua trees, the tallest plants, are sparsely distributed though most of the area. The tallest and most conspicuous shrub is creosote bush. There are several species of shrubs on most sites. The herb cover is sparse during the summer. Bluegrass and desert needlegrass are widely distributed, but red brome grass is generally the most

extensive grass. Bluegrass is more abundant on some north-facing slopes. Most of the shrubs listed in Table 3, except desert alyssium and gray felt-thorn, are widely distributed. Gray felt-thorn was found on north-facing slopes.

MANAGEMENT RECOMMENDATIONS

The area surveyed is dominated by shallow soils over schist or granitic rock parent materials. The landscapes are of mid-Pleistocene to late-Holocene age. The soils occupying many of these surfaces are relict paleosols (fossil soils) which formed under moist conditions compared to the arid conditions of the current climate. Stability of the soil landscapes varies with depth to bedrock, age, slope, aspect, and position.

With these issues in mind, we recommend that, prior to construction, mining, or other disturbance, as much of the soil profile as possible be removed and stockpiled. Areas of rock outcrop will be obstacles in places. The soils are generally shallow to bedrock, except for soils of the drainageways, and the seed bank of the stockpiled soils should be considered a valuable revegetation resource. Many of the seeds of native species within the surface spoils should be viable when the stockpiled soil material is returned to the final contoured surfaces.

Fertilizer application may be problematic. If irrigation water is available at the time of reclamation, then a complete fertilizer (nitrogen, phosphorous, and potassium) can be considered. Without supplemental water, risk of fertilizer burn damage in this arid climate would be high. Some consideration should be given to using a slow-release form of fertilizer if supplemental water during seedling establishment phases is available. We can provide some recommendations of fertilizer type and application rates on request and on review of revegetation plans.

Plant selection for revegetation purposes should involve review of native species growing on the site, an assessment of their suitability for revegetation and erosion control, and a review of seed or seedling availability for those species chosen. Matching appropriate species to soils and site conditions involves assessing water and nutritional requirements, slope and aspect (exposure) factors, landform stability, and potential for regeneration of selected species. Candidate species should be identified which have some chance of establishment in the vicinity.

Plants selected for revegetation/reclamation of the site should be chosen based on their usefulness in dust control, erosion control, wildlife habitat (food and shelter), slope stabilization, and aesthetics. Decisions on where to plant which species involves matching the species to the particular needs of the site. Additionally, differences in site-specific characteristics such as water-holding capacity of soils, depth to bedrock, landscape activity, and traffic patterns should be considered. Revegetation planning should be undertaken before construction or soil disturbance commence if possible. Further recommendations for revegetation must be site-specific and tied to

the soil/landscape interpretations. These guidelines are general and should be used in initial planning only.

Please contact the offices of K&AES if further information is needed or if clarification of this report is necessary. The information contained in this report is not intended to be used to assess slope stability, soil engineering properties, or load-bearing capacities of soils. The survey presented here can be used to locate natural soil units, assess revegetation potential, and provide general soils resource information for future planning.

SOIL MAP UNITS

Soil map unit delineations were based on landform, slope gradient, and soils. Soil map units are named by kinds of dominant soils (Table 1) utilizing the terminology of Soil Taxonomy (Soil Survey Staff, 1992). It might be more convenient for map and report users who are not pedologists to identify the map units by landform and slope (Table 1). The name, whether landform or soils, is not the map unit description. Any comprehensive application of the soil resource inventory requires consultation of the map unit descriptions. The soils have been mapped in southeastern Kern County (Valverde and Hill, 1981), but the soils and soil map units are slightly different in the Randsburg area.

Am - Floodplains - Fluventic Camborthids, 2 to 12% slopes

90% Fluventic Camborthids

10% inclusions of Fluventic Torriorthents along stream channels

The soils of these floodplains are in stratified, gravelly and very gravelly, sand, loamy sand, and sandy loam deposits of sediment from metamorphic terrain. They are well drained, but they flood occasionally.

Altitude: 3200 to 4400 feet

Fluventic Camborthids (Pedons 14 and 20): These soils are deep to very deep over weathered (soft) schist or related metamorphic rock. They are in coarse-loamy, mixed, thermic and loamy-skeletal, mixed thermic families. They have cambic horizons. Indicators of soil development (cambic horizon formation) include leaching of lime from the surface and its accumulation in lower horizons, soil color, and soil structure. Bladder sage is much more abundant on these soils than on adjacent pediments.

Vegetation: creosote bush, cheese bush, bladder sage, ephedra, and red brome grass

Surface soil: 2 to 10 inches, pale brown, gravelly to very gravelly loamy sand to sandy loam, slightly calcareous, pH 8

Subsoil: light yellowish brown, gravelly to very gravelly loamy sand to sandy loam, calcareous, pH 8

Substratum: soft (weathered), highly-fractured bedrock at 3.5 to 10 feet deep
Coarse fragments (2-250 mm): surface, 15-45%; profile mean (vol.), 25-45%
Infiltration: moderately rapid
Available water capacity: low
Permeability, subsoil: moderately rapid
Runoff, surface: slow
Erosion hazard: water low; wind high

Bg - Granitic Butte - shallow Typic Haplargids, 3-18% slopes

90% loamy, mixed, thermic, shallow Typic Haplargids
10% Rock Outcrop

The soils in this map unit are on the relatively flat summit of a granitic butte.

Altitude: 4280 to 4370 feet

Loamy, mixed, thermic, shallow Typic Haplargids (Pedon 8): These are well drained soils on massive (sparsely-fractured) bedrock that weathers to grus. They are shallow and non-calcareous in the subsoil.

Vegetation: blackbush, California buckwheat, and red brome grass

Surface soil: 3 to 4 inches, light brown, gravelly coarse sandy loam to gravelly sandy loam, calcareous, pH 8

Subsoil: yellowish red, gravelly sandy clay loam, non-calcareous, pH 8

Substratum: grus at 12 to 20 inches depth

Coarse fragments (2-250 mm): surface, 20-30%; profile mean (vol.), 25-35%

Infiltration: moderately rapid

Available water capacity: low

Permeability, subsoil: moderate

Runoff, surface: moderate

Erosion hazard: water moderate; wind high

Em - Eolian Sand - Typic Torriorthents, 12-60% slopes

85% sandy, mixed, thermic Typic Torriorthents

15% inclusions of shallow Typic Torripsamments and Typic Camborthids

The soils in this map unit are on the east or northeast sides of hills, downwind from drained tailings ponds. They are excessively well drained.

Altitude: 3400 to 3600 feet

Sandy, mixed, thermic Typic Torriorthents (Pedon 10): These are moderately deep to deep, excessively well drained, soils in eolian sand deposited over soils of the Mm and Ms map units.

Vegetation: creosote bush, burrobrush, California buckwheat, and indigo bush

Surface soil: 20 to 40 inches, light brown, sand, calcareous, pH 8

Subsoil: buried Typic Camborthids of map units Mm and Ms

Substratum: soft (weathered), highly fractured bedrock at 40 to 60 inches depth

Coarse fragments (2-250 mm): surface, <1%; profile mean (vol.), 1-35%

Infiltration: very rapid

Available water capacity: very low

Permeability, subsoil: moderate

Runoff, surface: low

Erosion hazard: water low; wind very high

Gp - Granitic Pediments, Orthids-Argids-Orthents, 3-15% slopes

30% loamy, mixed, thermic, shallow Typic Camborthids

25% fine-loamy, mixed, thermic Typic Haplargids

25% loamy, mixed (nonacid), thermic, shallow Typic Torriorthents

20% inclusions of Typic Durorthids in areas of hydrothermally altered bedrock, rock outcrop, and deep Typic Torripsamments along ephemeral stream courses

The soils in this map unit are on a diffusely dissected pediment. They appear to be in an association rather than in a complex, but the area of this map unit was too small to warrant the separation of simplexes ("consociations").

Altitude: 3750-3950 feet

Loamy, mixed, thermic, shallow Typic Camborthids (Pedon 21): These soils are 10 to 20 inches deep on massive (sparsely-fractured) bedrock that weathers to grus. They are well drained taxadjuncts of the Randsburg Series which is calcareous but lacks a cambic horizon.

Vegetation: creosote bush, cheesebush, bladder sage, Mormon tea, red brome grass, and desert needlegrass

Surface soil: 1 to 2 inches, brown, gravelly loamy coarse sand to gravelly sandy loam, non-calcareous, pH 8

Subsoil: yellowish brown, gravelly sandy loam, non-calcareous, pH 8

Substratum: grus at 10 to 20 inches depth

Coarse fragments (2-250 mm): surface, 12-18%; profile mean (vol.), 15-20%

Infiltration: moderately rapid

Available water capacity: low

Permeability, subsoil: rapid

Runoff, surface: moderate

Erosion hazard: water moderate; wind high

Fine-loamy, mixed, thermic Typic Haplargids (Pedon 13): These are moderately deep to deep, well drained soils on massive (sparsely-fractured) bedrock that weathers to grus.

Vegetation: creosote bush, California buckwheat, cheesebush, Mormon tea, red brome grass, and desert needle grass

Surface soil: 4 to 5 inches, brown, gravelly loamy coarse sand to gravelly sandy loam, non-calcareous, pH 8

Subsoil: strong brown, gravelly sandy loam to gravelly sandy clay loam, non-calcareous, pH 8

Substratum: grus at 20 to 60 inches depth

Coarse fragments (2-250 mm): surface, 12-18%; profile mean (vol.), 15-20%

Infiltration: moderately rapid

Available water capacity: moderate

Permeability, subsoil: moderate

Runoff, surface: moderate

Erosion hazard: water moderate; wind high

Loamy, mixed (nonacid), thermic, shallow Typic Torriorthents (Pedon 22): These are very shallow, somewhat excessively well drained soils on massive (sparsely-fractured) bedrock that weathers to grus.

Vegetation: creosote bush, California buckwheat, cheesebush, blackbush, Mormon tea, an annual fescue, red brome grass, and desert needle grass

Surface soil: 1 to 3 inches, brown, gravelly loamy coarse sand to gravelly sandy loam, non-calcareous, pH 8

Subsoil: yellowish brown, gravelly sandy loam, non-calcareous, pH 7

Substratum: grus at 4 to 10 inches depth, sparse rock outcrop

Coarse fragments (2-250 mm): surface, 15-20%; profile mean (vol.), 20-30%

Infiltration: moderately rapid

Available water capacity: very low

Permeability, subsoil: moderate

Runoff, surface: rapid

Erosion hazard: water high; wind high

Gs - Steep Granitic Terrain - shallow Torripsamments, 25-65% slopes

80% mixed, thermic, shallow Typic Torripsamments

20% inclusions of Rock Outcrop, Lithic Torriorthents and Lithic Camborthids on dike rock,

and Xerollic Camborthids in colluvial footslopes

The soils in this map unit are on steep mountain slopes. They are somewhat excessively well drained.

Altitude: 3800-4400 feet

Mixed (calcareous), thermic, shallow Typic Torripsamments (Pedon 2): These soils are 4 to 20 inches deep on massive (sparsely-fractured) bedrock that weathers to grus. They are somewhat excessively well drained.

Vegetation: creosote bush, Mormon tea, spiny hopsage, indigo bush, desert aster, red brome grass, and desert needlegrass

Surface soil: 2 to 7 inches, pale brown, gravelly loamy coarse sand to gravelly loamy sand, calcareous, pH 8

Subsoil: light yellowish brown, gravelly loamy sand, calcareous, pH 8

Substratum: grus at 4 to 20 inches depth

Coarse fragments (2-250 mm): surface, 12-30%; profile mean (vol.), 10-20%

Infiltration: rapid

Available water capacity: very low

Permeability, subsoil: rapid

Runoff, surface: rapid

Erosion hazard: water high; wind high

Gv - Very Steep Granitic Terrain - Camborthids-Rock Outcrop, 60-85% slopes

60% loamy-skeletal, mixed, thermic Xerollic Camborthids

20% Rock Outcrop at the top of the slope

20% inclusions of Lithic Torriorthents, Lithic Camborthids, and shallow Typic Torripsamments on dike rock and near rock outcrop

The soils in this map unit are on very steep mountain slopes. The Xerollic Camborthids are in colluvium, downslope from the rock outcrop and shallow soils.

Altitude: 4000-4300 feet

Loamy-skeletal, mixed, thermic, Xerollic Camborthids (Pedon 9): These are moderately deep, somewhat excessively well drained soils on massive (sparsely-fractured) bedrock that weathers to grus. They have coarse fragment contents that place some in loamy-skeletal and others in coarse-loamy families.

Vegetation: California buckwheat, spiny hopsage, bladder sage, Mormon tea, and bluegrass

Surface soil: 4 inches, brown, gravelly sandy loam, calcareous, pH 8

Subsoil: yellowish brown, gravelly to very gravelly sandy loam, non-calcareous, pH 8

Substratum: grus at 20 to 40 inches depth

Coarse fragments (2-250 mm): surface, 30-45%; profile mean (vol.), 30-45%

Infiltration: moderate

Available water capacity: low to moderate

Permeability, subsoil: moderate

Runoff, surface: rapid

Erosion hazard: water high; wind high

M2 - Gently Sloping Pediments - very gravelly Typic Haplargids, 3-12% slopes

80% loamy-skeletal, mixed, thermic, Typic Haplargids on flat interfluves

20% inclusions of shallow Typic Camborthids on interfluve sideslopes and Fluventic Camborthids in drainageways

The soils in this map unit are on slightly dissected pediments of schist and related metamorphic rocks.

Altitude: 3200-4000 feet

Loamy-skeletal, mixed, thermic, Typic Haplargids (Pedon 12): These soils are moderately deep on soft (weathered), highly-fractured metamorphic rock. They are well drained. In some pedons, there is a calcic horizon beneath the argillic horizon.

Vegetation: creosote bush, burrobrush, California buckwheat, spiny hopsage, cheesebush, goldenbush,

Mormon tea, red brome grass, and annual fescue

Surface soil: 4 to 9 inches, pale brown, gravelly to very gravelly sandy loam to loam, pH 8

Subsoil: brown to strong brown, gravelly to very gravelly sandy clay loam to loam, non-calcareous in at least the upper part of the argillic horizon, pH 8

Substratum: saprolite at 20 to 40 inches depth

Coarse fragments (2-250 mm): surface, 20-40%; profile mean (vol.), 30-45%

Infiltration: moderate

Available water capacity: low to moderate

Permeability, subsoil: slow

Runoff, surface: moderate

Erosion hazard: water moderate; wind low

M3 - Moderately Sloping Pediments - Haplargids-Camborthids, 6-18% slopes

60% loamy-skeletal, mixed, thermic Typic Haplargids on flat interfluves

20% loamy-skeletal, mixed, thermic, shallow Typic Camborthids on interfluve sideslopes

10% inclusions of rock outcrop on interfluvial sideslopes and Fluventic Camborthids in drainageways

The soils in this map unit are on much dissected pediments of schist and related metamorphic rocks with relatively flat interfluvies.

Altitude: 3300-4000 feet

Loamv-skeletal, mixed, thermic, Typic Haplargids (Pedon 12): These soils are moderately deep on soft (weathered), highly-fractured metamorphic rock. They are well drained. In some pedons, there is a calcic horizon beneath the argillic horizon.

Vegetation: creosote bush, burrobush, California buckwheat, spiny hopsage, cheesebush, goldenbush,

Mormon tea, red brome grass, and annual fescue

Surface soil: 4 to 9 inches; pale brown, gravelly to very gravelly sandy loam to loam, pH 8

Subsoil: brown to strong brown, gravelly to very gravelly sandy clay loam to loam, non-calcareous in at least the upper part of the argillic horizon, pH 8

Substratum: saprolite at 20 to 40 inches depth

Coarse fragments (2-250 mm): surface, 20-40%; profile mean (vol.), 30-45%

Infiltration: moderate

Available water capacity: low to moderate

Permeability, subsoil: slow

Runoff, surface: moderate

Erosion hazard: water moderate; wind low

Loamv-skeletal, mixed, thermic, shallow Typic Camborthids (Pedon 6): These soils are 20 to 40 inches deep on soft (weathered), highly-fractured metamorphic rock. They are well drained.

Vegetation: creosote bush, California buckwheat, spiny hopsage, cheesebush, goldenhead, Mormon tea,

red brome grass, and bluegrass

Surface soil: 2 to 6 inches, pale brown to light yellowish brown, very gravelly sandy loam, calcareous, pH 8

Subsoil: light yellowish brown, very gravelly sandy loam to loam, calcareous, pH 8

Substratum: saprolite at 10 to 20 inches depth

Coarse fragments (2-250 mm): surface, 30-45%; profile mean (vol.), 40-50%

Infiltration: moderate

Available water capacity: low

Permeability, subsoil: moderate

Runoff, surface: rapid

Erosion hazard: water moderate; wind low

Mm - Moderately Steep Hills - shallow Typic Camborthids, 12-30% slopes

80% loamy-skeletal, mixed, thermic, shallow Typic Camborthids

20% inclusions of rock outcrop, shallow Haplargids on gentle summit slopes, and

Lithic Torriorthents on shoulder and steep sideslopes

The soils in this map unit are shallow on weathered schist and related metamorphic rocks.

Altitude: 3300 to 4600 feet

Loamy-skeletal, mixed, thermic, shallow Typic Camborthids (Pedon 6): These soils are 20 to 40 inches deep on soft (weathered), highly-fractured metamorphic rock. They are well drained.

Vegetation: creosote bush, California buckwheat, spiny hopsage, cheesebush, goldenhead, Mormon tea, red brome grass, and bluegrass

Surface soil: 2 to 6 inches, pale brown to light yellowish brown, very gravelly sandy loam, calcareous, pH 8

Subsoil: light yellowish brown, very gravelly sandy loam to loam, calcareous, pH 8

Substratum: saprolite at 10 to 20 inches depth

Coarse fragments (2-250 mm): surface, 30-45%; profile mean (vol.), 40-50%

Infiltration: moderate

Available-water capacity: low

Permeability, subsoil: moderate

Runoff, surface: rapid

Erosion hazard: water moderate; wind low

Mp - Dissected Pediments - gravelly Typic Haplargids, 3-15% slopes

80% fine-loamy, mixed, thermic Typic Haplargids

20% inclusions of shallow Typic Camborthids on moderately steep interfluvial sideslopes and Fluventic

Camborthids in drainageways

The soils in this map unit are on dissected pediments of schist and related metamorphic rocks with rounded interfluvial ("ballenas").

Altitude: 3700 to 4500 feet

Fine-loamy, mixed, thermic, Typic Haplargids (Pedon 19): These soils are moderately deep on soft (weathered), highly-fractured metamorphic rock. They are well drained. In some pedons, there is a calcic horizon beneath the argillic horizon.

Vegetation: creosote bush, blackbush, cheesebush, burrobush, goldenbush, box thorn, Mormon tea, desert aster, and red bromegrass

Surface soil: 6 to 8 inches, pale brown, gravelly sandy loam, non-calcareous, pH 8

Subsoil: brownish to reddish yellow, gravelly sandy clay loam, non-calcareous in at least the upper part of the argillic horizon, pH 8

Substratum: saprolite at 20 to 40 inches depth

Coarse fragments (2-250 mm): surface, 12-30%; profile mean (vol.), 15-30%

Infiltration: moderate

Available water capacity: moderate

Permeability, subsoil: slow

Runoff, surface: moderate

Erosion hazard: water moderate; wind low

Ms - Steep Metamorphic Terrain - Camborthids-Lithic Torriorthents, 25-65% slopes

60% loamy-skeletal, mixed, thermic, shallow Typic Camborthids

20% loamy-skeletal, mixed (calcareous), thermic, Lithic Torriorthents

20% inclusions of rock outcrop, shallow Typic Haplargids on broad ridge summit slopes, and deep to very deep Typic Camborthids on colluvial footslopes

The soils in this map unit are mostly shallow to moderately deep on weathered schist and related metamorphic rocks.

Altitude: 3200 to 4700 feet

Loamy-skeletal, mixed, thermic, shallow Typic Camborthids (Pedon 6): These soils are 20 to 40 inches deep on soft (weathered), highly-fractured metamorphic rock. They are well drained.

Vegetation: creosote bush, California buckwheat, spiny hopsage, cheesebush, goldenhead, Mormon tea, red bromegrass, and bluegrass

Surface soil: 2 to 6 inches, pale brown to light yellowish brown, very gravelly sandy loam, calcareous, pH 8

Subsoil: light yellowish brown, very gravelly sandy loam to loam, calcareous, pH 8

Substratum: saprolite at 10 to 20 inches depth

Coarse fragments (2-250 mm): surface, 30-45%; profile mean (vol.), 40-50%

Infiltration: moderate

Available-water capacity: low

Permeability, subsoil: moderate

Runoff, surface: rapid

Erosion hazard: water moderate; wind low

Loamy-skeletal, mixed (calcareous), thermic Lithic Torriorthents (Pedon 4): These soils are 4 to 10 inches deep on soft (weathered), highly-fractured metamorphic rock. They are somewhat excessively well drained.

Vegetation: creosote bush, California buckwheat, burrobush, cheesebush, red brome grass, and needlegrass

Surface soil: 1 to 2 inches, pale brown, very gravelly sandy loam, calcareous, pH 8

Subsoil: very pale brown, very gravelly sandy loam, calcareous, pH 8

Substratum: hard, flaggy bedrock at 4 to 10 inches depth

Coarse fragments (2-250 mm): surface, 60-75%; profile mean (vol.), 40-60%

Infiltration: moderate

Available water capacity: very low

Permeability, subsoil: moderate

Runoff, surface: very rapid

Erosion hazard: water moderate; wind low

Mv - Very Steep Metamorphic Terrain - Torriorthents-Camborthids, 60-85% slopes

40% loamy-skeletal, mixed (calcareous), thermic Lithic Torriorthents

30% loamy-skeletal, mixed, thermic shallow Typic Camborthids

20% Rock Outcrop

10% inclusions of deep to very deep Typic Camborthids on colluvial footslopes

The soils in this map unit are mostly very shallow and shallow on weathered schist and related metamorphic rocks.

Altitude: 3200 to 4700 feet

Loamv-skeletal, mixed (calcareous), thermic Lithic Torriorthents (Pedon 4): These soils are 4 to 10 inches deep on soft (weathered), highly fractured metamorphic rock. They are somewhat excessively well drained.

Vegetation: creosote bush, California buckwheat, burrobush, cheesebush, red brome grass, and needlegrass

Surface soil: 1 to 2 inches, pale brown, very gravelly sandy loam, calcareous, pH 8

Subsoil: very pale brown, very gravelly sandy loam, calcareous, pH 8

Substratum: hard, flaggy bedrock at 4 to 10 inches depth

Coarse fragments (2-250 mm): surface, 60-75%; profile mean (vol.), 40-60%

Infiltration: moderate

Available water capacity: very low

Permeability, subsoil: moderate

Runoff, surface: very rapid

Erosion hazard: water moderate; wind low

Loamy-skeletal, mixed, thermic, shallow Typic Camborthids (Pedon 6): These are well drained soils 20 to 40 inches deep on soft (weathered), highly-fractured bedrock.

Vegetation: creosote bush, California buckwheat, spiny hopsage, cheesebush, goldenhead, Mormon tea, red brome grass, and bluegrass

Surface soil: 2 to 6 inches, pale brown to light yellowish brown, very gravelly sandy loam, calcareous, pH 8

Subsoil: light yellowish brown, very gravelly sandy loam to loam, calcareous, pH 8

Substratum: saprolite at 10 to 20 inches depth

Coarse fragments (2-250 mm): surface, 30-45%; profile mean (vol.), 40-50%

Infiltration: moderate

Available water capacity: low

Permeability, subsoil: moderate

Runoff, surface: rapid

Erosion hazard: water moderate; wind low

Table 1. Map Unit Names

Symbol	Landform	Soil	Slope
Am	Floodplains	Fluventic Camborthids	2-12%
Bg	Granitic Butte	shallow Typic Haplargids	3-18%
Em	Eolian Sand	Typic Torriorthents	12-60%
Gp	Granitic Pediments	Orthids-Argids-Orthents	3-15%
Gs	Steep Granitic Terrain	shallow Torripsamments	25-65%
Gv	Very Steep Granitic Terrain	Camborthids-Rock Outcrop	60-85%
M2	Gently Sloping Pediments	very gravelly Typic Haplargids	3-12%
M3	Moderately Sloping Pediments	Haplargids-Camborthids	6-18%
Mm	Moderately Steep Hills	shallow Typic Camborthids	12-30%
Mp	Dissected Pediments	gravelly Typic Haplargids	3-15%
Ms	Steep Metamorphic Terrain	Camborthids-Torriorthents	25-65%
Mv	Very Steep Metamorphic Terrain	Torriorthents-Camborthids	60-85%
X	Mechanically Disturbed Land		

The soil map units are mostly simplexes ("consociations") and complexes of soil taxonomic units. Unit Gp is more an association than a complex.

Table 2. List of the soil taxonomic units.

Order/Suborder/Group/Subgroup/ and Families	Common Name	Map Units	Soil Depth	Rep. Pedon
Aridisols/Argids/Haplargids/Typic Haplargids				
fine-loamy, mixed, thermic	Mirage	Gp	DD	13
fine-loamy, mixed, thermic	Garlock	Mp	DD	9(18)
loamy, mixed, thermic, shallow	Chimenea	Bg	SS	8
loamy-skeletal, mixed, thermic	Bitter	M2,M3	MD	5,12
loamy-skeletal, mixed, thermic, shallow	Ankham	Mm,Ms	SS	(15)(16)
Aridisols/Orthids/Camborthids/Typic Camborthids				
loamy, mixed, thermic, shallow		Gs,Gp	SS	21
loamy-skeletal, mixed, thermic, shallow		Mm,Ms	SS	6
Aridisols/Orthids/Camborthids/Fluventic Camborthids				
loamy-skeletal, mixed, thermic		Am	DD	20
coarse-loamy, mixed, thermic		Am	DD	14
Aridisols/Orthids/Camborthids/Xerollic Camborthids				
loamy-skeletal, mixed, thermic		Gv	MD	9
loamy-skeletal, mixed, thermic, shallow		Mv	SS	17
Entisols/Orthents/Torriorthents/Typic Torriorthents				
loamy, mixed (nonacid), thermic, shallow		Gp	VS	22
sandy, mixed, thermic		Em	MD	10
Entisols/Orthents/Torriorthents/Lithic Torriorthents				
loamy-skeletal, mixed (calcareous), thermic	Tecopa	Ms,Mv	VS	4
Entisols/Psamments/Torripsamments/Typic Torripsamments				
mixed, thermic, shallow	Jawbone	Gs,Gv	SS	2

Soil depth classes: DD, deep; MD, moderately deep; SS, shallow; VD, very deep; and VS, very shallow.

Table 3. Plant species recorded on pedon descriptions, listed alphabetically by symbol.

Symbol	Botanical Name	Common Name
Tree-like		
YucBre	<i>Yucca brevifolia</i>	Joshua tree
Shrubs		
AcaSpa	<i>Acamptopappus sphaerocephalus</i>	goldenhead
AmbDum	<i>Ambrosia dumosa</i>	burrobush or bur-sage
ColRam	<i>Coleogyne ramosissima</i>	blackbush
Dalea	<i>Psoralea arborescens</i> formerly <i>Dalea fremontii</i>	Mojave indigo bush
EncFar	<i>Encelia farinosa</i>	brittlebush or incienso
Ephedra	<i>Ephedra</i> spp	Mormon tea
EriCoo	<i>Ericameria cooperi</i>	goldenbush
EriFas	<i>Eriogonum fasciculatum</i>	California buckwheat
GraSpi	<i>Grayia spinosa</i>	spiny hop-sage
HymSal	<i>Hymenoclea salsola</i>	cheesebush or burrobush
LarDiv	<i>Larrea tridentata</i> formerly <i>L. divaricata</i>	creosote bush
LepFre	<i>Lepidium fremontii</i>	desert alyssium
LycAnd	<i>Lycium andersonii</i>	box thorn
SalMex	<i>Salazaria mexicana</i>	bladder sage
TetCan	<i>Tetradymia canescens</i>	gray felt-thorn
XylTor	<i>Xylorhiza tortifolia</i>	desert aster
Herbs		
AmsTes	<i>Amsinckia tessellata</i>	fiddleneck
Chia	<i>Salvia columbariae</i>	chia
Coreopsis	<i>Coreopsis (bigelovii?)</i>	tickseed
EroCic	<i>Erodium cicutarium</i>	filaree
EriInf	<i>Eriogonum inflatum</i>	desert trumpet
Euphorbia	<i>Chamaesyce albomarginata</i>	rattlesnake weed
Gilia	<i>Gilia</i> spp	gilia
Phacelia	<i>Phacelia</i> spp	phacelia
SalKal	<i>Salsola tragus</i> formerly <i>S. kali</i>	Russian thistle tumbleweed
Grasses		
BroRub	<i>Bromus rubens</i> including little <i>B. tectorum</i>	red brome grass
Fescue	<i>Festuca</i> spp	annual fescue
PoaSec	<i>Poa secunda</i>	varied bluegrass
StiSpe	<i>Stipa speciosa</i>	desert needlegrass

Botanical names, except grasses, are current names in the Jepson Manual (Hickman, editor, 1993).

Table 4. Symbols and abbreviations in pedon (soil) site descriptions.

Slope Shape (19b)

Format: perpendicular to contour (1 letter), parallel to contour (1 letter)

Symbols: L, linear; N, concave; V, convex

Texture (26d)

Format: modifier (0-2 letters), texture of fine earth (1-4 letters)

Symbols, fine earth: c, clay; cl, clay loam; cols, coarse loamy sand; cosl, coarse sandy loam; l, loam; lcos, loamy coarse sand; ls, loamy sand; s, sand; scl, sandy clay loam; sl, sandy loam

Symbols, modifier: eg, extremely gravelly; g, gravelly; vg, very gravelly

Structure (26e)

Format: development (1 number, or character), size (1-2 letters, 1-3 sizes), type (2-3 letters)

Symbols, development: 0, none; 1, weak; 2, moderate; 3, strong

Symbols, size: c, coarse; f, fine; m, medium; vf, very fine

Symbols, type: abk, angular blocky; m, massive; pl, platy; sbk, subangular blocky; sg, single grain

Consistence, dry (26f1)

Symbol: h, hard; s, soft; sh, slightly hard; vh, very hard

Consistence, moist (26f2)

Symbol: fi, firm; fr, friable; vfi, very firm; vfr, very friable

Consistence, wet (26f3)

Symbol: p, plastic; po, nonplastic; ps, slightly plastic; s, sticky; so, nonsticky; ss, slightly sticky; vs, very sticky

Cutans (clay coatings, 26g1)

Format: surface cover (1 number), thickness (1-2 letters), surface type or location (2-3 letters)

Symbols, surface cover: 1, sparse; 2, common; 3, extensive; 4, complete

Symbols, thickness: k, thick; mk, moderately thick; n, thin

Symbols, surface type or location: pf, ped faces; tpo, tubular pores

Rock Fragments (26g2)

Symbol: CB, cobbles; GR, gravel (pebbles); ST, stones

Roots (26g3)

Format: abundance (1 number or a letter and a number), size (1-2 letters)

Symbols, abundance: 1, few; 2, common; 3, many; v1, very few

Symbols, size: c, coarse; f, fine; m, medium; vf, very fine

Effervescens Class (26h)

Symbol: e, effervescent; es, strongly effervescent; n, noneffervescent; vs, violently effervescent

Boundary (26j)

Format: distinctness (1 letter), topography (1 letter)

Symbol, distinctness: a, abrupt; c, clear; d, diffuse; g, gradual

Symbol, topography: b, broken or discontinuous; i, irregular; s, smooth; w, wavy

Definitions of these features are given in the Soil Survey Manual of the Soil Conservation Service, USDA.

REFERENCES

- Hulin, C.D. 1925. Geology and ore deposits of the Randsburg Quadrangle, California. Calif. Min. Bur., Bull. 95.
- Morehouse, J.A. 1988. A Synopsis of the Geologic and Structural History of the Randsburg Mining District. M.S. Thesis, Dept. Geosciences, Univ. Arizona, Tucson.
- Soil Survey Staff. 1992. Keys to Soil Taxonomy. SMSS Tech. Monogr.19. Pocahontas Press, Blacksburg, VA.
- Valverde, M.A., and H.L. Hill. 1981. Soil Survey of Kern County, Southeastern Part. USDA, Soil Conservation Service.



1. Map Unit Symbol G-3	2. Family or Series mixed thermic, shallow	3. Date 5/20/93	4. By EBA	5. Photo. No.	6. Stop No. 2	7. USGS Quad	8. Location: Sec. 3 T. 30S R. 40E
9. Area Rand Mining	10. Typic Terrisprament	11.		12. State CA	13. County Kern		
14. Parent Material granitic	15. Bedrock Name Atoia	16. Elevation 4060	17. Erosion: a. Kind		b. Class		
18. Landform mountain side	19. Slope: a. % 56 b. Shape L-L c. Length	20. Drainage Class WSW	21. Surface Stone and Rock a. CR 5 b. CD 15 c. ST 5 d. BY 2		22. Potential Natural Vegetation		
23. Annual Precipitation		24. Measured Soil Temperature		25. Water Table (Depth)			

HORI- ZON DE- SIGNA- TION (a)	COLOR (c)		TEXTURE (d) %C	STRUC- TURE	CONSISTENCE (f)			SPECIAL FEATURES (g)						FIELD pH	EFFER. CLASS	BOUNDARY	
	D Moist (1)	M-Dry (2)			Mottling (3)	Dry (1)	Moist (2)	Wet (3)	Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)					
A 0-4	10YR 6/3	10YR 4/2		gls	0sg				GR-12								
AB 4-18	10YR 6/4	10YR 4/3		ls	0m				ST-9								CS
Bw 18-28	10YR 6/4	10YR 4/4		gls	0m				ST-20								GS
Cr 28-35+	salt and pepper				0m												CW

EXISTING VEGETATION									
30. (Species)	TREES (% Crown Cover)	31. (Species)	SHRUBS (% Crown Cover)	32. (Species)	FORBS (% Crown Cover)	33. (Species)	GRASSES (% Crown Cover)		
		Lar Div	2	Amst Tes		Bro Rub	<1		
		Ephedra	5	Eri Inf		Sti Spe			
		Dalea	1	Chia					
		Graspi	1						
		Xyl Ter	1						
		Hym Sal	1						



1. Map Unit Symbol MS	2. Family or Series loamy-skeletal, mixed, thermic	3. Date 5/20/93	4. By EBA	5. Photo. No.	6. Slope No. 3	7. USGS Quad	8. Location: Sec. <u>3</u> T. <u>303</u> R. <u>40E</u>
9. Area Rand Mining	10. Lithic, Ruptic-Entic Haplargid	11. Elevation 4080		12. State CA	13. County Kern		
14. Parent Material Schist	15. Bedrock Name Rand	16. Erosion: a. Kind b. Class					
18. Landform steep mountain side	19. Slope: a. % <u>45</u> b. Shape <u>LV</u> c. Length d. Aspect <u>NW</u>	20. Drainage Class <u>Well</u>	21. Surface Stone and Rock a. GR <u>40</u> b. CB <u>3</u> c. ST <u>2</u> d. BY				
22. Potential Natural Vegetation	23. Annual Precipitation		24. Measured Soil Temperature		25. Water Table (Depth)		

HORI- ZON DE- SIGNA- TION	DEPTH cm (b)	COLOR (c)		TEXTURE (d) SEC.	STRUC- TURE	CONSISTENCE (f)			SPECIAL FEATURES (g)				EFFER. CLASS	FIELD pH	BOUNDARY
		D Mott	M Dry			Dry	Molat	Wet	Cutans	% of Rock Fragments	Roots	Forss			
A1	0-4	10YR 6/4	(2) 4/3	10YR 4/3	vgsl 1/2	S		SS PO		GR-45 CB- ST-	vl f, m		e	8	CS
A2	4-14	10YR 6/4	(2) 4/3	10YR 4/3	vgsl 1/2	S		SS PO		GR-30 CB- ST-	vl f, f vl m		e	8	9/a
Bt	14-20	10YR 6/4	(2) 5/4	10YR 5/4	2vrf, f abk	sh	fr	S sp		GR-50 CB- ST-	vl f, f m, c		-	8	ab
Cr	20-100+									GR- CB- ST-					

Cr - highly fractured, hard where very shallow, soft where deeper

EXISTING VEGETATION								
30. (Species)	TREES (% Crown Cover)	31. (Species)	SHRUBS (% Crown Cover)	32. (Species)	FORBS (% Crown Cover)	33. (Species)	GRASSES (% Crown Cover)	
		AcaSpa	10			BroRub	10	
		EriFas	2			StiSpe		
		AmbDum	3					
		GraSpi	3					
		Ephedra	2					
		LycAnd	1					
		XylTor						

1. Map Unit Symbol MV	2. Family or Series loamy-skeletal, mixed, thermic	3. Date 5/20/93	4. By EBA	5. Photo. No.	6. Strip No. 4	7. USCS Quad	8. Location: Sec. 3 T. 30S R. 40E	
9. Area Rand Mining	10. Lithic Torriorthent	11. Elevation 3940	12. State CA	13. County Kern				
14. Parent Material Schist	15. Bedrock Name Rand	16. Erosion: a. Kind Well	17. Drainage Class Well	18. Slope: a. % 5.2 b. Shape LL c. Length	19. Aspect SE	20. Measured Soil Temperature	21. Surface Stone and Rock a. GR 60 b. CB 10 c. ST 5 d. BY	
18. Landform Very steep mountain side	22. Potential Natural Vegetation	23. Annual Precipitation						24. Measured Soil Temperature
								25. Water Table (Depth)

HORI- ZON DE- SIGNA- TION	DEPTH cm (b)	COLOR (c)		Mottling (3)	TEXTURE (d) SEC	STRUC- TURE (e)	CONSISTENCE (f)			SPECIAL FEATURES (g)				EFFER. CLASS (h)	FIELD pH (i)	BOUNDARY (j)
		D Moist (1)	M Dry (2)				Dry (1)	Moist (2)	Wet (3)	Outcrops (1)	% of Rock Fragments (2)	Roots (3)	Forces (4)			
A	0-5	10YR 7/4	10YR 4/3		vgsl	impl	s		SB	po		GR-40 CB- ST-			8	CS
AB	5-14	10YR 7/4	10YR 4/3		vgsl	om	s		SB	po		GR-35 CB- ST-			8	CS
Bw	14-22	10YR 7/4	10YR 5/3		vgsl	vsf sbk	sh		SB	sp	nil	GR-60 CB- ST- GR- CB- ST- GR- CB- ST-			8	ai
R	22+															

R - highly fractured schist, flaggy

EXISTING VEGETATION							
30. (Species)	TREES (% Crown Cover)	31. (Species)	SHRUBS (% Crown Cover)	32. (Species)	FORBS (% Crown Cover)	33. (Species)	GRASSES (% Crown Cover)
		EriFas	5	AmStes	6	BroRub	3
		HymSal	5	Coriopsis	3	StiSpe	1
		LarDiv	2	Chia	2		
		AmoDum	2	EriInf			
		GraSpi	1	Phacelia sp			
		SalMex	1				



1. Map Unit Symbol M2	2. Family or Series loamy-skeletal mixed, thermic	3. Date 5/21/98	4. By EBA	5. Photo. No.	6. Stop No. 5	7. USGS Quad	8. Location: Sec. 3 T. 305 N. 40E
9. Area Rand Mining	10. Typic Haplargid	11.			12. State CA	13. County Kern	
14. Parent Material Schist	15. Bedrock Name Rand (Cr at 92 cm)	16. Elevation 3800	17. Erosion: a. Kind		b. Class		
18. Landform mountain footslope	19. Slope: a. % 30 b. Shape VV c. Length	d. Aspect NW	20. Drainage Class Well		21. Surface Stone and Rock a. CR 40 b. CB 5 c. ST 1 d. BY		
22. Potential Natural Vegetation		23. Annual Precipitation		24. Measured Soil Temperature		25. Water Table (Depth)	

HORI- ZON DE- SIGNA- TION (a)	COLOR (c)		TEXTURE (d) (e)	STRUC- TURE (f)	CONSISTENCE (g)			SPECIAL FEATURES (h)				EFFER. CLASS (i)	FIELD pH (j)	BOUNDARY (k)
	D Moist (1)	M Dry (2)			Mottling (3)	Wet (3)	Moist (2)	Dry (1)	Roots (3)	% of Rock Fragments (2)	Foras (4)			
A	10YR 6/3	10YR 4/3	vgl 14	1m,c pl	s	ss	ss	CR-30 CB-5 ST-	1v,f,m			e	8	cs
AB	10YR 6/4	10YR 4/4	vgl 16	1m,c sbl	s/sh	ss	sp	CR-40 CB-2 ST-	1v,f,f m,c			e	8	gs
BA	10YR 6/4	10YR 4/4	vgl 18	2f,m sbl	sh	ss	sp	CR-35 CB-1 ST-	1v,f,f m,c			e	8	cs
Bt.	7.5YR 5/5	7.5YR 5/5	gcl 38	2m,c abk	vh	vs	p	CR-20 CB-2 ST-	1v,f,f m,c			n	6.5	aw
Btca	7.5YR 5/5	7.5YR 5/5	vg scl 28	2f,m abk	h	s	p	CR-40 CB-2 ST-	1v,f,f m,c			ev	8	gs
cca 74-92		10YR 6/3	7.5YR 5/5	egsl 12	sh	ss	po	60 10	1v,f,f m,c			ev	8	ac

EXISTING VEGETATION									
30. (Species)	TREES (% Crown Cover)	31. (Species)	SHRUBS (% Crown Cover)	32. (Species)	FORNS (% Crown Cover)	33. (Species)	GRASSES (% Crown Cover)		
YucBre	<1	Am bDum	10	Am sTes	1	Br sRub	10		
		Gra Sp.	3			PosSec	5		
		EriFal	3			Fescue	1		
		LarDiv	5						
		ColRam							
		LycAnd							
		HymSal							
		Ephedra							

1. Map Unit Symbol <i>Ms</i>	2. Family or Series <i>loamy-skeletal, mixed, thermic</i>	3. Date <i>5/21/93</i>	4. By <i>EBB</i>	5. Photo. No.	6. Stop No. <i>6</i>	7. USGS Quad	8. Location: Sec. <i>1</i> T. <i>30S</i> R. <i>40E</i>
9. Area <i>Rand Mining</i>	10. <i>shallow Typic Camborthid</i>	11. <i>CA</i>			12. State	13. County <i>Kern</i>	
14. Parent Material <i>schist</i>	15. Bedrock Name <i>Rand</i>	16. Elevation <i>3970</i>	17. Erosion: a. Kind	b. Class			
18. Landform <i>hillside</i>	19. Slope: a. % <i>4/2</i> b. Shape <i>L V</i> c. Length	20. Drainage Class <i>Well</i>	21. Surface Stone and Rock a. GR <i>30</i> b. CB <i>3</i> c. ST <i>< 1</i> d. BY				
22. Potential Natural Vegetation	23. Annual Precipitation		24. Measured Soil Temperature		25. Water Table (Depth)		

HORI- ZON DE- SIGNA- TION (a)	COLOR (c)		Mottling (3)	TEXTURE (d) %C	STRUC- TURE (e)	CONSISTENCE (f)			SPECIAL FEATURES (g)				EFFER. CLASS (h)	FIELD pH (i)	BOUNDARY	
	D Moist (1)	M Dry (2)				Dry (1)	Moist (2)	Wet (3)	Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)				
A	10YR 6/3	10YR 4/3		vgsl 12	1m pl	S			SS PO	CR-50 CB- ST-		if v/m				CS
AB	10YR 6/4	10YR 4/4		vgsl 14	1vf, f sbl	S			SS PO	GR-40 CB- ST-		1vf, m				GS
Bw	10YR 5/4	10YR 4/4		vgsl 16	1vf, f sbl	S			SS PO	GR-40 CB- ST-		2vf 1m				ai
Cr																

Cr - highly fractured schist that can dig out with a spade

EXISTING VEGETATION									
30. (Species)	TREES (% Crown Cover)	31. (Species)	SHRUBS (% Crown Cover)	32. (Species)	FORDS (% Crown Cover)	33. (Species)	GRASSES (% Crown Cover)		
<i>Yucca Brea</i>	< 1	<i>Hym Sal</i>	10	<i>Eri Inf</i>	1	<i>Poa Sec</i>		5	
		<i>Lar Div</i>	1			<i>Bro Rub</i>		5	
		<i>Gra Spi</i>	2						
		<i>Eri Fas</i>	1						
		<i>Ephedra</i>	1						
		<i>Dalea</i>							
		<i>Xyl Tar</i>							

1. Map Unit Symbol Bg	2. Family or Series loamy, mixed, thermic, shallow	3. Date 5/22/93	4. By EBA	5. Photo. No.	6. Stop No. 8	7. USGS Quad	8. Location: Sec. 2 T. 30S R. 40E
9. Area Rand Mining	10. Typic Haplargid	11.		12. State CA	13. County Kern		
14. Parent Material granitic	15. Bedrock Name Atolia	16. Elevation ft. 4340	17. Erosion: a. Kind				
18. Landform mesa	19. Slope: a. % 4 b. Shape LL c. Length	20. Drainage Class Well	21. Surface Stones and Rock a. CR 20 b. CB 4 c. ST 1 d. BY				
22. Potential Natural Vegetation		23. Annual Precipitation	24. Measured Soil Temperature	25. Water Table (Depth)			

HORI- ZON DE- SIGNA- TION (a)	COLOR (c)			TEXTURE (d)	STRUC- TURE (e)	CONSISTENCE (f)			SPECIAL FEATURES (g)				EFFER- CLASS (h)	FIELD pH (i)	BOUNDARY (j)
	D Moist (1)	M Dry (2)	Wet (3)			Catena (1)	% of Rock Fragments (2)	Roots (3)	Foras (4)	ST. - CR - CB - ST -					
A	10YR 6/5	7.5YR 4/3		g/coh 6	1m pl	S		So		CR - 30 CB - ST -	1f, m		e	8	as
AB	7.5YR 6/5	7.5YR 4/4		gsl 10	1vff sbk	S		ss po		CR - 18 CB - 2 ST -	1vff, f, m		e	8	cw
Bt1	5YR 5/6	5YR 4/6		gsl 22	2fabb	vh	fi	S sp	3ml pf+tpo	CR - 30 CB - 3 ST -	1vff f, m		n	8	gs
Bt2	7.5YR 6/6	7.5YR 5/6		Vgsl 22	1m abk	vh		S sp		CR - 35 CB - 5 ST -	1vff f, m		n	6	al
Cr										CR - CB - ST -					

Cr - weathered bedrock

EXISTING VEGETATION							
30. (Species)	TREES (% Crown Cover)	31. (Species)	SHRUBS (% Crown Cover)	32. (Species)	FORBS (% Crown Cover)	33. (Species)	GRASSES (% Crown Cover)
		ColRam	10	EroCic		BroRub	
		EriFas	2				
		AcaSpa	2				
		Ephedra	<1				
		XylTor	1				





1. Map Unit Symbol <i>Em</i>	2. Family or Series <i>Sandy, mixed, thermic</i>	3. Date <i>5/23/93</i>	4. By <i>EBA</i>	5. Photo. No.	6. Stop No. <i>10</i>	7. USGS Quad	8. Location: Sec. <i>35</i> T. <i>29S</i> R. <i>40E</i>
9. Area <i>Rand Mining</i>	10. <i>Typic Torriorthent</i>	11.		12. State <i>CA</i>	13. County <i>Kern</i>		
14. Parent Material <i>collan sand/schist</i>	15. Bedrock Name	16. Elevation <i>3570</i>	17. Erosion: a. Kind		b. Class		
18. Landform <i>hillslope</i>	19. Slope: a. % <i>45</i> b. Shape <i>LL</i> c. Length	20. Drainage Class <i>Well</i>	21. Surface Stone and Rock a. CR <i>0</i> b. CB <i>0</i> c. ST <i>0</i> d. BY <i>0</i>		22. Potential Natural Vegetation		
23. Annual Precipitation		24. Measured Soil Temperature		25. Water Table (Depth)			

HORI- ZON DE- SIGNA- TION	COLOR (c)		TEXTURE (d) %C	STRUC- TURE	CONSISTENCE (f)			SPECIAL FEATURES (g)				FIELD pH	BOUNDARY
	Moist	Dry			Mottling	Dry	Moist	Wet	Outcrops	% of Rock Fragments	Roots		
C1	10YR 6/4	10YR 5/4	S	0.5g	loose	(1) (2) (3)			CR - 0	0		(h) (i) (j)	
C2	10YR 6/4	10YR 5/4	S	0m	S	vfr			CR - 0	v/vf, f		e 8	CS
C3	10YR 6/4	10YR 5/4	S	0m to 0.5g	loose	vfr			CR - 0	lvf, f		e 8	ai
72+									CR - >35				
									CR -				
									CR -				
									CR -				
									CR -				

72+ buried soil/schist

EXISTING VEGETATION									
30. (Species)	TREES (% Crown Cover)	31. (Species)	SHRUBS (% Crown Cover)	32. (Species)	FORBS (% Crown Cover)	33. (Species)	GRASSES (% Crown Cover)		
		<i>AmbDum</i>	5	<i>Eri Inf</i>			<i>None</i>		
		<i>Dalea</i>	5						
		<i>LarDiv</i>	2						
		<i>Salmex</i>	5						
		<i>EriFas</i>	5						
		<i>HymSal</i>	5						
		<i>GraSpi</i>	5						
		<i>Xy1Tor</i>	1						



1. Map Unit Symbol Gp	2. Family or Series fine-loamy mixed, thermic	3. Date 5/24/93	4. By EBA	5. Photo. No.	6. Stop No. 13	7. USGS Quad	8. Location: Sec. 1 T. 30S R. 40E
9. Area Rand Mining	10. Typic Haplargid	11.			12. State CA	13. County Kern	
14. Parent Material granitic	15. Bedrock Name Atolia	16. Elevation 3860'	17. Erosion: a. Kind		b. Class		
18. Landform rolling pediment	19. Slope: a. % 12 b. Shape VV c. Length	20. Drainage Class WNW	d. Aspect WELL		21. Surface Stone and Rock a. CR 5 b. CB 1 c. ST d. BY		
22. Potential Natural Vegetation		23. Annual Precipitation			24. Measured Soil Temperature		
25. Water Table (Depth)							

HORI- ZON DE- SIGNA- TION (a)	COLOR (c)			TEXTURE (d) %C	STRUC- TURE (e)	CONSISTENCE (f)			SPECIAL FEATURES (g)					EFFER- CLASS (h)	FIELD pH (i)	BOUNDARY
	Moist (1)	Dry (2)	Mottling (3)			Dry (1)	Moist (2)	Wet (3)	Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)				
A	10YR 5/3	10YR 3/2		g/cos G	Om	S	SS		CR-15 CB-1 ST-	v/f, m		n	8	as		
AB	10YR 5/4	10YR 3/3		gsi 12	1f5bk	S	SS		CR-12 CB- ST-	v/f, f, m		n	8	cs		
Bt1	7.5YR 5/5	7.5YR 4/3		sci 21	1mslk	sh	S	bridges only	CR-15 CB- ST-	v/f, f, m		n	8	gs		
Bt2	7.5YR 6/5	7.5YR 4/4		sl 10	1csbk	sh	SS	between grains	CR-20 CB- ST-	v/vf, f, m		n	8	d		
BC	7.5YR 6/5	7.5YR 4/3		ls 8	Om		so		CR-20 CB- ST-	v/vf, f, m		n	8	ai		

Cr 125-150+ grus, massive bedrock

EXISTING VEGETATION											
30. (Species)	TREES	(% Crown Cover)	31. (Species)	SHRUBS	(% Crown Cover)	32. (Species)	FORBS	(% Crown Cover)	33. (Species)	GRASSES	(% Crown Cover)
			AmbDum		3	EroCic		5	BroRub		10
			EriCoo		3				StiSpe		2
			Ephedra		3						
			LarDiv		3						
			HymSal		3						
			LycAnd		1						
			AcaSpa		1						
			ColRam		1						

1. Map Unit Symbol <i>Am</i>	2. Family or Series <i>loamy-skeletal, mixed, thermic</i>	3. Date <i>5/25/93</i>	4. By <i>EB A</i>	5. Photo. No.	6. Stop No. <i>14</i>	7. USGS Quad	8. Location: Sec. <i>10</i> T. <i>30S</i> R. <i>40E</i>
9. Area <i>Rand Mining</i>	10. <i>Fluventic Camborthid</i>	11.			12. State <i>CA</i>	13. County <i>Kern</i>	
14. Parent Material <i>Schist</i>	15. Bedrock Name <i>Rand</i>	16. Elevation <i>4280'</i>	17. Erosion: a. Kind	b. Class			
18. Landform <i>floodplain</i>	19. Slope: a. % <i>10</i> b. Shape <i>LL</i> c. Length	d. Aspect <i>SSE</i>	20. Drainage Class <i>Well</i>	21. Surface Stone and Rock a. GR <i>20</i> b. CB <i>0</i> c. ST <i>0</i> d. BY <i>0</i>			
22. Potential Natural Vegetation		23. Annual Precipitation		24. Measured Soil Temperature			
				25. Water Table (Depth)			

HORI- ZON DE- SIGNA- TION (a)	DEPTH (b)	COLOR (c)		TEXTURE (d) %C	STRUC- TURE (e)	CONSISTENCE (f)			SPECIAL FEATURES (g)				EFFER. CLASS (h)	FIELD pH (i)	BOUNDARY
		Molst (1)	Dry (2)	Mottling (3)		Dry (1)	Molst (2)	Wet (3)	Outcane (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)			
A	0-5	10YR 6/3	10YR 3/3		gsi 1m, c 5bk	S		SS po		GR - 76 CB - ST -	v/f v/f		e	8	aw
BW	5-21	10YR 6/4	10YR 4/4		gsi 1fm 5bk	S		SS po		GR - 24 CB - ST -	2v/f, f 1m, c		e	8	cw
BC	21-75	10YR 6/3	10YR 4/3		vgsl 1fm 5bk	S		SS po		GR - 30 CB - 5 ST -	1v/f, f m, c		es	8	d
Cca	75-128	10YR 6/3	10YR 4/3	white streaks	vgsl 0m	S	vfr	SS po		GR - 40 CB - 5 ST -	1v/f, f f, m, c		ev	8	ai
R	128+									GR - CB - ST -					

R - highly fractured, moderately hard schist (bedrock)

EXISTING VEGETATION											
30. (Species)	TREES	(% Crown Cover)	31. (Species)	SHRUBS	(% Crown Cover)	32. (Species)	FORBS	(% Crown Cover)	33. (Species)	GRASSES	(% Crown Cover)
			LarDiv		5	AmstEs		3	BroRuL		10
			AcaSpa		4	EroCic		1	StiSpe		1
			HymSal		5						
			Ephedra		2						
			SalMex		1						
			GraSpi		1						
			LycAnd								
			ColRam								

1. Map Unit Symbol <i>Mm</i>	2. Family or Series <i>loamy-skeletal, mixed, thermic</i>	3. Date <i>5/25/93</i>	4. Ily <i>EBA</i>	5. Photo. No.	6. Stop No. <i>15</i>	7. USGS Quad	8. Location: Sec. <i>11</i> T. <i>30S</i> R. <i>40E</i>
9. Area <i>Rand Mining</i>	10. <i>Shallow Typic Haplargid</i>	11.			12. State <i>CA</i>	13. County <i>Kern</i>	
14. Parent Material <i>SEHst</i>	15. Bedrock Name <i>Rand</i>	16. Elevation <i>4230'</i>	17. Erosion: a. Kind		b. Class		
18. Landform <i>hill side</i>	19. Slope: a. % <i>28</i> b. Shape <i>VV</i> c. Length	20. Drainage Class <i>Well</i>	21. Surface Stone and Rock a. GR <i>30</i> b. CB <i>20</i> c. ST <i>10</i> d. BY		25. Water Table (Depth)		
22. Potential Natural Vegetation		23. Annual Precipitation		24. Measured Soil Temperature			

HORI- ZON DE- SIGNA- TION (a)	COLOR (c)		TEXTURE (d) %C	STRUC- TURE (e)	CONSISTENCE (f)			SPECIAL FEATURES (g)				EFFER. CLASS (h)	FIELD pH (i)	BOUNDARY (j)
	Moist (1)	Dry (2)			Mottling (3)	Dry (1)	Moist (2)	Wet (3)	Outcane (1)	% of Rock Fragments (2)	Roots (3)			
A	10YR 5/4	10YR 4/3		om	S		SS		GR-30 CB-10 ST-	V/f, m		11	8	as
Bt	10YR 4/4	10YR 5/3		1f, m sbk	sh		SS SP	2nbf	GR-50 CB-15 ST-	2vf, f 1m		11	8	ai
Cr									GR- CB- ST-	V/vf, f, m		11		

Cr - highly fractured, weathered bedrock

EXISTING VEGETATION									
30. (Species)	TREES (% Crown Cover)	31. (Species)	SHRUBS (% Crown Cover)	32. (Species)	FORBS (% Crown Cover)	33. (Species)	GRASSES (% Crown Cover)		
Cholla (cactus)		EriFas	3	Chia	1	BroRub	5		
		HymSal	3	Euphorbia		StiSpe	<1		
		Ephedra	3						
		AmbDum	3						
		SalMex	3						
		ColRam	3						
		LarDiv	2-						
		GraSpi	1	Pala					

1. Map Unit Symbol <i>M5</i>	2. Family or Series <i>loamy-skeletal, mixed, thermic</i>	3. Date <i>5/26/93</i>	4. By <i>EB</i>	5. Photo. No.	6. Stop No. <i>16</i>	7. USGS Quad	8. Location: Sec. <i>2</i> T. <i>30S</i> R. <i>40E</i>
9. Area <i>Rand Mining</i>	10. <i>shallow Typic Haplargid</i>	11.			12. State <i>CA</i>	13. County <i>Kern</i>	
14. Parent Material <i>granitic & dike rock</i>	15. Bedrock Name	16. Elevation <i>4440'</i>	17. Erosion: a. Kind		b. Class		
18. Landform <i>mountain side</i>	19. Slope: a. % <i>27</i> b. Shape <i>VV</i> c. Length	d. Aspect <i>Well</i>	20. Drainage Class		21. Surface Stone and Rock a. GR <i>25</i> b. CB <i>2</i> c. ST <i>1</i> d. BY		
22. Potential Natural Vegetation		23. Annual Precipitation		24. Measured Soil Temperature			
				25. Water Table (Depth)			

HORI- ZON DE- SIGNA- TION (a)	DEPTH (b)	COLOR (c)		TEXTURE (d) %C	STRUC- TURE (e)	CONSISTENCE (f)			SPECIAL FEATURES (g)				EFFER. CLASS (h)	FIELD pH (i)	BOUNDARY (j)
		Molt	Dry			Dry (1)	Molt (2)	Wet (3)	Cutans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)			
A	0-2	10YR 5/4	10YR 4/3	vglcos	1 mbl	S		so		GR - 40 CB - ST -	v/f, m		n	8	as
AB	2-6	10YR 5/5	10YR 4/4	gsi	2vf sbk	S		ss		GR - 25 CB - ST -	2vf 1f, m		n	8	aw
Bt1	6-15	7.5YR 5/6	7.5YR 5/6	vgsl ped faces svr 4/5	2m sbk	h		3	3mk pf, tpo	GR - 50 CB - ST -	1vf, f m		n	8	gs
Bt2	15-27	7.5YR 5/6	7.5YR 5/6	vgsl	1m sbk	h	fi	5	2mk pf, tpo	GR - 40 CB - ST -	1vf, f m		n	8	al
Cr	27-35+									GR - CB - ST -					

Cr - weathered, massive bedrock

EXISTING VEGETATION											
30. (Species)	TREES	(% Crown Cover)	SHRUBS	(% Crown Cover)	32. (Species)	FORB	(% Crown Cover)	33. (Species)	GRASSES	(% Crown Cover)	
			Lar Div	1	Ero Cic		1	Bro Rub		5	
			Col Ram	5	Amst Es						
			Hym Sal	5							
			Eri Fas	2							
			Ephedra	1							
			Lyc And	1							
			Gra Spi	<1							
			Dalea	<1							

1. Map Unit Symbol <i>Mp</i>	2. Family or Series <i>loamy mixed, thermic</i>	3. Date <i>5/26/93</i>	4. BY <i>EBB</i>	5. Photo. No.	6. Stop No. <i>18</i>	7. USGS Quad	8. Location: Sec. <i>a</i> T. <i>303</i> R. <i>40E</i>
9. Area <i>Rand Mining</i>	10. <i>shallow Typic Haplargid</i>	11.			12. State <i>CA</i>	13. County <i>Kern</i>	
14. Parent Material <i>Schist</i>	15. Bedrock Name <i>Rand</i>	16. Elevation <i>4250'</i>	17. Erosion: a. Kind		b. Class		
18. Landform <i>pediment</i>	19. Slope: a. %	b. Shape	c. Length	d. Aspect <i>102°</i>	20. Drainage Class		
22. Potential Natural Vegetation	23. Annual Precipitation				24. Measured Soil Temperature		
				25. Water Table (Depth)			

HORI- ZON DE- SIGNA- TION (a)	COLOR (c)		TEXTURE (d) %C	STRUC- TURE (e)	CONSISTENCE (f)			SPECIAL FEATURES (g)			EFFER. CLASS (h)	FIELD pH (i)	BOUNDARY
	Moist (1)	Dry (2)			Dry (1)	Moist (2)	Wet (3)	Outcrops (1)	% of Rock Fragments (2)	Roots (3)			
A	10YR 6/3	10YR 4/3	gls 8	lmp	S		so		GR - 12 CB - 1	vlf, m	n	8	as
AB	10YR 6/4	10YR 4/4	sl 10	lf, m sbl	S		ss		GR - B CB - 1 ST -	lvf, f, m	n	8	cw
BA	10YR 6/5	10YR 4/4	gsl 15	lm, c sbl	sh		ss		GR - 15 CB - 1 ST -	lvf, f, m	n	8	d
Bt1	7.5YR 6/5	10YR 4/4	gsl 18	lf, m, c sbl		fr	ss	1n tpo	GR - 15 CB - 1 ST -	vlvf, f, m, c	n	7.5	gs
Bt2	7.5YR 6/6	7.5YR 5/5	gsl 24	om		fi	s	3mk tpo	GR - 20 CB - 1 ST -	vlvf, f, m, c	n	7	al

Cr 45-50+ highly fractured, weathered bedrock

EXISTING VEGETATION									
30. (Species)	TREES (% Crown Cover)	SHRUBS (% Crown Cover)	32. (Species)	FORBS (% Crown Cover)	GRASSES (% Crown Cover)	33. (Species)	GRASSES (% Crown Cover)	34. (Species)	GRASSES (% Crown Cover)
<i>YueBre</i>	1	<i>Lardiv</i>	5	<i>Amstel</i>	10	<i>BroRub</i>	10		
		<i>HymSal</i>	6	<i>Gilia sp</i>		<i>PoaSec</i>	2		
		<i>AmbDum</i>	2			<i>StiSpe</i>			
		<i>EriCoo</i>	2						
		<i>ColRam</i>	2						
		<i>LycAnd</i>	1						
		<i>Ephedra</i>	1						
		<i>XylTor</i>							





1. Map Unit Symbol <i>Am</i>	2. Family or Series <i>Coarse-loamy, mixed, thermic</i>	3. Date <i>5/27/93</i>	4. By <i>EBA</i>	5. Photo. No.	6. Stop No. <i>20</i>	7. USGS Quad	8. Location: Sec. <i>12</i> , T. <i>305</i> R. <i>40E</i>
9. Area <i>Rand Mining</i>	10. <i>Fluventic Camborthid</i>	11.		12. State <i>CA</i>		13. County <i>Kern</i>	
14. Parent Material <i>Schist</i>	15. Bedrock Name <i>Rand</i>	16. Elevation <i>3870</i>	17. Erosion: a. Kind		b. Class		
18. Landform <i>floodplain</i>	19. Slope: a. % <i>4</i> b. Shape <i>L.L.</i> c. Length	20. Drainage Class <i>Wcll</i>		21. Surface Stone and Rock a. GR <i>40</i> b. CB <i>2</i> c. ST		d. BY	
22. Potential Natural Vegetation		23. Annual Precipitation		24. Measured Soil Temperature			
25. Water Table (Depth)							

HORI- ZON DE- SIGNA- TION (a)	COLOR (c)		Mottling (3)	TEXTURE (d) % (e)	STRUC- TURE (f)	CONSISTENCE (g)			SPECIAL FEATURES (h)				EFFER. CLASS (n)	FIELD pH (i)	BOUNDARY (j)
	Moist (1)	Dry (2)				Dry (1)	Moist (2)	Wet (3)	Catans (1)	% of Rock Fragments (2)	Roots (3)	Pores (4)			
A1	10YR 6/3	10YR 3/3		gls 8	1m,c p1	S		50	50	GR - 25 CB - 1 ST -	1vlf,m		n	8	as
A2	10YR 6/3	10YR 4/3		vgls 9	1f,m sbl	S		30	30	GR - 40 CB - 2 ST -	2vf		e	8	cw
Bw	10YR 6/4	10YR 4/4		gsl 18	1m,c sbl		fr	55	55	GR - 20 CB - 1 ST -	1vlf,f m,c		es	8	cw
BC	10YR 6/4	10YR 4/4		vgls 8	Om		fr	50	50	GR - 45 CB - 5 ST -	1vlf,p m,c		e	8	cw
Cca	10YR 6/4	10YR 5/4	thin white streaks	vgls 6	Om		fr	50	50	GR - 45 CB - 5 ST -	1vlf,f f,m,c		es	8	ai

cr 118+ highly fractured, weathered schist

EXISTING VEGETATION									
30. (Species)	TREES (% Crown Cover)	31. (Species)	SHRUBS (% Crown Cover)	32. (Species)	FORBS (% Crown Cover)	33. (Species)	GRASSES (% Crown Cover)		
		LarDiv	4	AmTes		BroRub	5		
		HymSal	8	Chia					
		SalMex	6						
		Ephedra	2						





APPENDIX D

Geologic Time Scale

TIME UNITS OF THE GEOLOGIC TIME SCALE (Numbers are absolute dates in millions of years before the present)			
Eon	Era	Period	Epoch
Phanerozoic Eon (Phaneros = "evident"; Zoon = "life")	Cenozoic Era	Quaternary	Recent or Holocene
			Pleistocene
		Tertiary	Pliocene
			Miocene
			Oligocene
			Eocene
			Paleocene
		65	
	Mesozoic Era	Cretaceous	140
		Jurassic	195
		Triassic	230
	Paleozoic Era	Permian	280
		Carboniferous	Pennsylvanian
			Mississippian
		345	
		Devonian	400
		Silurian	435
		Ordovician	500
		Cambrian	600
Precambrian or Cryptozoic Eon	Proterozoic		2600
	Archean		3800
	No Record		

|
 Cryptozoic
 Comprises
 About
 87%
 of the
 Geologic
 Time Scale

↓
 Origin of Earth About 4.6 Billion Years Ago



APPENDIX E

**Hydrogeological Analysis for Proposed
Increased Groundwater Pumpage, Fremont Valley,
California, Which Includes Appendices A Through D**



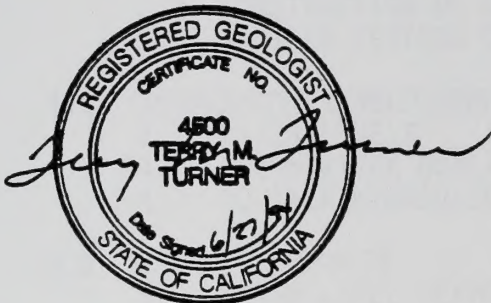
HARGIS + ASSOCIATES, INC.

June 27, 1994

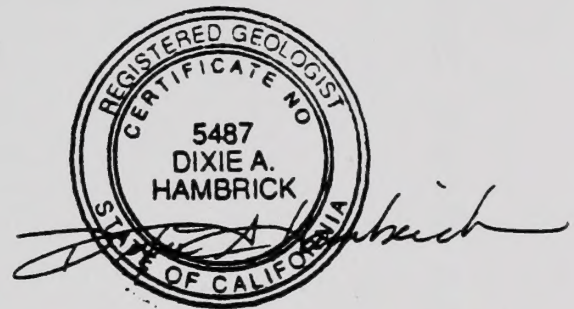
HYDROGEOLOGICAL ANALYSIS FOR
PROPOSED INCREASED GROUNDWATER PUMPAGE
NORTHERN FREMONT VALLEY, CALIFORNIA

Prepared for
RAND MINING COMPANY

By
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HYDROGEOLOGICAL ANALYSIS FOR
PROPOSED INCREASED GROUNDWATER PUMPAGE
NORTHERN FREMONT VALLEY, CALIFORNIA

TABLE OF CONTENTS

Section	Page
EXECUTIVE SUMMARY	ES-1
1.0 INTRODUCTION	1
2.0 FREMONT VALLEY GROUNDWATER BASIN	3
2.1 GEOLOGY	4
2.2 HYDROGEOLOGY	6
2.3 GROUNDWATER PUMPAGE AND RECHARGE	7
3.0 RESULTS OF FIELD INVESTIGATIONS	10
3.1 WATER LEVEL MEASUREMENTS AND GROUNDWATER SAMPLING	10
3.2 CONSTRUCTION OF OBSERVATION WELL OW-1	12
3.3 AQUIFER TESTING OF PRODUCTION WELL RMC-4	14
4.0 GROUNDWATER CONDITIONS	15
4.1 WATER LEVELS	15
4.2 GROUNDWATER QUALITY	17
4.3 AQUIFER HYDRAULIC PARAMETERS	19
5.0 MODELING RESULTS	23
5.1 WATER LEVEL RESPONSE	25
5.1.1 Case 1: Production Well RMC-4 Pumping Alone, Without the Rand Project	26
5.1.2 Case 2: Production Well RMC-4 Pumping Alone, With the Rand Project	26
5.1.3 Case 3: Production Well RMC-4 and Regional Wells Pumping, Without the Rand Project	27
5.1.4 Case 4: Production Well RMC-4 and Regional Wells Pumping, With the Rand Project	28
5.1.5 Additional Water Level Declines Due to the Rand Project	30
5.2 GROUNDWATER QUALITY CHANGES	31
5.3 DISCUSSION	32
6.0 POTENTIAL IMPACTS OF PROPOSED INCREASED GROUNDWATER PUMPAGE	35
7.0 CONCLUSIONS	38
8.0 REFERENCES CITED	40



TABLE OF CONTENTS (continued)

TABLES

Table

- | | |
|---|--|
| 1 | PROJECTED GROUNDWATER PRODUCTION, RAND MINING COMPANY |
| 2 | WELL DATA, NORTHERN FREMONT VALLEY |
| 3 | ROUTINE CONSTITUENTS IN GROUNDWATER SAMPLES, NORTHERN FREMONT VALLEY WELLS |
| 4 | MAXIMUM CONTAMINANT LEVELS FOR ORGANIC AND INORGANIC ANALYTES |
| 5 | GROUNDWATER CONDITIONS AND AQUIFER HYDRAULIC PARAMETERS, NORTHERN FREMONT VALLEY |
| 6 | PROJECTED DRAWDOWNS |

ILLUSTRATIONS

Figure

- | | |
|----|--|
| 1 | FREMONT VALLEY BASIN |
| 2 | WELL LOCATIONS, NORTHERN FREMONT VALLEY |
| 3 | WATER LEVEL ELEVATIONS FOR REPRESENTATIVE NORTHERN FREMONT VALLEY WELLS |
| 4 | WATER LEVEL ELEVATIONS, MAY 1994, NORTHERN FREMONT VALLEY |
| 5 | INORGANIC GROUNDWATER QUALITY, NORTHERN FREMONT VALLEY |
| 6 | GROUNDWATER CONDITIONS AND AQUIFER HYDRAULIC PARAMETERS, NORTHERN FREMONT VALLEY |
| 7 | PROJECTED EXTENT OF DRAWDOWN AFTER 6 YEARS, MODEL CASE 1 |
| 8 | PROJECTED EXTENT OF DRAWDOWN AFTER 16 YEARS, MODEL CASE 1 |
| 9 | PROJECTED EXTENT OF DRAWDOWN AFTER 6 YEARS, MODEL CASE 2 |
| 10 | PROJECTED EXTENT OF DRAWDOWN AFTER 16 YEARS, MODEL CASE 2 |



TABLE OF CONTENTS (continued)

Figure

- 11 PROJECTED EXTENT OF DRAWDOWN AFTER 6 YEARS, MODEL CASE 3
- 12 PROJECTED EXTENT OF DRAWDOWN AFTER 16 YEARS, MODEL CASE 3
- 13 PROJECTED EXTENT OF DRAWDOWN AFTER 6 YEARS, MODEL CASE 4
- 14 PROJECTED EXTENT OF DRAWDOWN AFTER 16 YEARS, MODEL CASE 4
- 15 PROJECTED WATER LEVEL ELEVATIONS AFTER 16 YEARS, MODEL CASE 3
- 16 PROJECTED WATER LEVEL ELEVATIONS AFTER 16 YEARS, MODEL CASE 4
- 17 CROSS SECTION OF PROJECTED DRAWDOWN, MODEL CASES 1 AND 2
- 18 PROJECTED CHANGE IN GROUNDWATER QUALITY AFTER 16 YEARS, MODEL CASE 4

APPENDICES

Appendix

- A RESULTS OF GROUNDWATER AND SOIL SAMPLE ANALYSES
- B LITHOLOGIC AND GEOPHYSICAL LOGS
- C AQUIFER TEST RESULTS
- D DESCRIPTION OF NUMERICAL MODELS





HYDROGEOLOGICAL ANALYSIS FOR
PROPOSED INCREASED GROUNDWATER PUMPAGE
NORTHERN FREMONT VALLEY, CALIFORNIA

EXECUTIVE SUMMARY

A hydrogeological analysis was performed by Hargis + Associates, Inc. for Rand Mining Company (RMC) to evaluate the potential impact of the proposed increased pumpage on groundwater conditions and vegetation in northern Fremont Valley, California, due to the Rand Project. Specifically, the potential impact on water levels and groundwater quality was evaluated in the vicinity of the Rand Communities Water District (RCWD) production wells.

Groundwater pumpage from RMC wells is projected to average 190 gallons per minute (gpm) during a 6-year period for currently approved mining operations. Groundwater pumpage is projected to increase to an average of approximately 345 gpm during a 16-year period for the Rand Project. The proposed groundwater production rate would be greatest during the first 11 years of the project, with an average pumping rate of approximately 450 gpm. The maximum average estimated production rate during this phase would be approximately 500 gpm. Groundwater production is proposed to decrease during the last 5 years, at which point the pumping rate would average 110 gpm. For the purposes of this hydrogeological analysis, the proposed annual estimates of groundwater production were assumed to be 24 hours per day, 365 days per year. In addition, it was assumed that the proposed increased groundwater production could be obtained from production well RMC-4.

The geologic and hydrogeologic conditions, and groundwater pumpage and recharge of northern Fremont Valley were evaluated based on data obtained during field investigations, provided by RMC, obtained from local industries and farms, and collected from federal, state, and local agencies. Agencies contacted included the RCWD, Antelope Valley-East Kern Water Agency, Kern County Water Agency, California Department of Water Resources, California Department of Mines and Geology, and U.S. Geological Survey. Based on these data, the extent and



characteristics of the aquifer and the regional water level trends were estimated.

Field investigations were conducted for this analysis in June 1993 and May 1994. June 1993 activities included a site reconnaissance survey, water level elevation measurement, and groundwater sample collection from production well RMC-4. May 1994 activities included drilling, construction, and development of an observation well in the immediate vicinity of production well RMC-4, and a 12-hour constant discharge aquifer test of production well RMC-4.

The results of these field investigations, published geologic maps, and hydrogeological data, including current and historical water levels, water quality information, and the specific capacities and pumping capabilities of wells throughout northern Fremont Valley were evaluated. These data suggest that aquifer hydraulic properties may vary across the area. In certain regions of the basin, variations in aquifer characteristics may, in part, be influenced by faults that act as groundwater barriers or that result in contrasting hydraulic conductivities of the aquifer on either side of the structure. Based on evaluation of the geological and hydrogeological data obtained for this analysis, the aquifer in the northern Fremont Valley groundwater basin appears to have differing hydraulic properties in four regions.

The four regions identified in the northern Fremont Valley groundwater basin are: 1) the portion of the basin north of the Garlock Fault, including, but not limited to, the area in the vicinity of production well RMC-4; 2) the northeastern portion of the basin, including areas in the vicinity of production wells RMC-1, RMC-2, RMC-3, and the Consolidated Placer Dredging (CPD) production wells; 3) the central portion of the basin, including the area in the vicinity of the RCWD production wells; and 4) the southwestern portion of the basin, including the agricultural wells northeast of Koehn Lake.

Based on the available lithologic and geophysical data, the aquifer throughout the northern Fremont Valley is comprised predominantly of sandy



gravels, gravelly sands, and silty sands with occasional silty and clayey horizons. Aquifer thickness throughout the valley is unknown. Based on lithologic logs available throughout the basin, the saturated thickness of the aquifer is at least 680 feet thick in the vicinity of production well RMC-4, 525 feet thick in the vicinity of the CPD production wells, and 225 feet thick in the vicinity of the RCWD production wells and the agricultural wells near Koehn Lake.

The aquifer north of the Garlock Fault is generally characterized by a steep groundwater gradient, magnesium-sulfate- or sodium-magnesium-sulfate-type groundwater, and wells with moderate specific capacities and pumping rates. Evaluation of the historical water levels and comparison of water quality data in this area to that in the remainder of the basin suggest that the Garlock Fault may influence groundwater flow by causing a contrast in hydraulic conductivity on either side of the fault. Based on the results of drilling and aquifer testing, the aquifer north of the Garlock Fault is estimated to have a transmissivity of approximately 44,000 gallons per day per foot (gpd/ft), a hydraulic conductivity of approximately 65 gallons per day per square foot (gpd/ft²), and a storativity of approximately 0.0004.

A storativity of 0.11 was previously estimated for the aquifer in the northern Fremont Valley. A storativity value of 0.0004 estimated from the aquifer test results is considered low based on previously published estimates, the lithologies of the aquifer materials encountered during drilling, and the short duration of the aquifer test. A storativity value of approximately 0.04 is considered more reasonable for the aquifer north of the Garlock Fault. Based on the similarity of the lithologies throughout the basin, this estimate of storativity is also considered reasonable for the entire northern Fremont Valley groundwater basin.

The aquifer in the northeastern portion of the basin is characterized by a moderately steep groundwater gradient, sodium-sulfate- or sodium-bicarbonate-type groundwater, and wells with low specific capacities and



low pumping rates. Based on these data, the aquifer in this portion of the basin has been estimated to have a transmissivity of approximately 3,800 gpd/ft and a hydraulic conductivity of approximately 7.5 gpd/ft².

The aquifer in the central portion of the basin in the vicinity of the RCWD production wells is characterized by a shallow groundwater gradient, sodium-bicarbonate-type groundwater, and wells with moderate specific capacities and moderate pumping rates. Based on these data, the aquifer in this portion of the basin has been estimated to have a transmissivity of approximately 30,000 gpd/ft and a hydraulic conductivity of approximately 150 gpd/ft².

The aquifer in the southwestern portion of the basin is characterized by a shallow groundwater gradient, sodium-chloride- and sodium-sulfate-type groundwater, and wells with high specific capacities and high pumping rates. Based on these data, the aquifer in this portion of the basin has been estimated to have a transmissivity of approximately 64,000 gpd/ft and a hydraulic conductivity of approximately 300 gpd/ft².

These estimated aquifer hydraulic parameters are similar to or slightly lower than previously published values. Published transmissivity estimates for the aquifer in northern Fremont Valley range from 60,000 gpd/ft in the central and southwestern portions of the basin to 150,000 gpd/ft in the northwestern portion of the basin, north of the Cantil Valley Fault Zone and the Garlock Fault.

Based on the similarity of historical water level elevations and groundwater quality in wells located on either side of the projection of the Cantil Valley Fault Zone, this fault zone does not appear to influence groundwater movement in the northern portion of Fremont Valley.

Regional water levels declined in northern Fremont Valley prior to 1979 on the order of 0.5 to 1 feet/year (ft/yr). After 1979, water level declines in the basin ranged from approximately 0.5 ft/yr in wells in the northeastern portion



of the basin to approximately 4 ft/yr in agricultural wells in the southwest. In general, a water level decline of approximately 3 ft/yr is considered to be an average value for the basin.

Numerical models were used to project water level responses and groundwater quality changes in the northern Fremont Valley due to the proposed increased pumpage associated with the Rand Project. Water level responses were projected using the MODFLOW groundwater flow model code. The PATH3D particle tracking model code was used to simulate the effects of RMC pumpage on groundwater quality in the basin.

To evaluate the potential effects of the proposed increased pumpage due to the Rand Project, four model cases were considered. These cases were developed to simulate the water level responses for different pumping conditions in northern Fremont Valley. For each simulation, aquifer parameters were kept constant and only pumping conditions were varied. In all cases, pumping rates for production well RMC-4 were based on RMC's average projected groundwater production rates. Pumping rates for regional wells were based on known or projected pumping patterns and were assumed to continue for 16 years unless otherwise documented.

For this analysis, Case 1 was defined as production well RMC-4 pumping alone, without the increased pumpage due to the Rand Project. Case 2 was defined as production well RMC-4 pumping alone, with the increased pumpage due to the Rand Project. Case 3 was defined as production well RMC-4 and regional wells pumping, without the increased pumpage due to the Rand Project. Case 4 was defined as production well RMC-4 and regional wells pumping, with the increased pumpage due to the Rand Project.

Each model case simulation was run for a 16-year pumping period, and projected drawdowns were plotted at the 6-, 12-, and 16-year time steps. The 6-year time step represents the end of RMC pumpage without the proposed Rand Project. The 12-year time step represents the end of the maximum RMC pumpage



associated with the proposed Rand Project. Except in the vicinity of production well RMC-4, the model results from the 12-year time step approximate the greatest drawdowns caused by the proposed increase in pumpage. In the vicinity of production well RMC-4, the greatest drawdowns would occur after 11 years due to the decrease in the proposed pumpage schedule for the Rand Project. The 16-year time step represents the end of RMC pumpage after completion of the proposed Rand Project.

Case 1 and Case 3 model simulations were performed to evaluate the water level response of pumpage without the proposed Rand Project. The results of these model simulations were compared to the results of Case 2 and Case 4 model simulations, respectively. Case 2 and Case 4 model results represent the effect of the proposed increased pumpage due to the Rand Project.

For Case 2, which was based on production well RMC-4 pumping alone, the total projected maximum water level decline in the vicinity of the production well RMC-4 due to the proposed increased pumpage of production well RMC-4 is approximately 20 feet after 11 years. For Case 4, which was based on production well RMC-4 and regional pumping, the total projected maximum water level decline in the vicinity of production well RMC-4 is approximately 51 feet after 11 years. The amount of additional water level decline due to the increased pumpage of production well RMC-4 projected at the end of 11 years is approximately 16 feet of the total 51 feet.

For Case 2, which was based on production well RMC-4 pumping alone, the total projected maximum water level decline in the vicinity of the RCWD production wells due to the proposed increased pumpage of production well RMC-4 is approximately 6 feet after 12 years. For Case 4, which was based on production well RMC-4 and regional pumping, the total projected maximum water level decline in the vicinity of these wells is approximately 48 feet after 16 years. The amount of additional water level decline due to the increased pumpage of production well RMC-4 projected at the end of 16 years is approximately 4 feet of the total 48 feet.



Due to the uncertainties associated with projecting regional pumpage over a 16-year period, the drawdown estimates for Case 1 and Case 2, which are based on production well RMC-4 pumping alone, are considered the most reasonable to evaluate the potential effects of the increased pumpage caused by the proposed Rand Project.

The impact associated with the increased pumpage due to the Rand Project was quantified based on the difference in drawdown projected for Case 1 and Case 2. The impact of the proposed increased pumpage due to the Rand Project is approximately 5 feet of additional water level decline in the vicinity of production well RMC-4 and 4 feet of additional water level decline in the vicinity of the RCWD production wells after a 16-year period. The projected maximum additional water level decline caused by the proposed increase in RMC pumpage is approximately 17 feet in the vicinity of production well RMC-4. The projected maximum additional water level decline in the vicinity of the RCWD production wells is approximately 6 feet.

The potential effects of water level declines on a production well include reduced well yield due to dewatering of aquifer material and pumping water levels falling below the level of the pump. The projected additional water level decline of 4 to 6 feet in the vicinity of the RCWD production wells is not likely to significantly reduce the saturated thickness of the aquifer in the vicinity of the RCWD production wells. Based on this analysis, the increased pumpage of production well RMC-4 is not likely to adversely impact the RCWD's ability to supply water from existing production wells. The projected regional water level decline of approximately 48 feet may, however, potentially impact groundwater production at these wells by reducing the saturated thickness of the aquifer.

Based on the depth of groundwater in Fremont Valley, the estimated water level declines due to RMC pumpage are not expected to impact the naturally occurring vegetation in the valley. The only vegetation in the valley that depends on groundwater are mesquite and salt cedar trees located at springs or along the margin of Koehn Lake. Additional water level declines on the order of



1 to 2 feet across the entire basin due to the proposed increased RMC pumpage are not likely to significantly impact the phreatophyte vegetation near the springs or along the margin of Koehn Lake. If, however, the regional pumping trends identified during this analysis continue, the projected amount of water level decline in the basin may affect the phreatophyte vegetation in northern Fremont Valley.

The impact of the proposed increased pumpage on groundwater quality in the basin is considered to be minor. Based on the modeling results, the potential effect of the proposed increase in RMC pumpage due to the Rand Project would not adversely affect groundwater quality in the vicinity of the RCWD production wells. The impact of the proposed increased pumpage on the vertical changes to groundwater quality in the basin were not addressed due to the limited water quality data available for this analysis.

Based on the hydrogeologic analysis performed, the increased pumpage of production well RMC-4 due to the proposed Rand Project is not likely to significantly impact water levels, groundwater quality, or natural vegetation in northern Fremont Valley. In particular, the additional water level decline projected in the vicinity of the RCWD production wells due to the Rand Project pumpage is not expected to significantly impact the groundwater quality or water supply of these wells. Based on the results of this hydrogeological analysis, no changes are recommended to the proposed plan for increasing pumpage at production well RMC-4.



HYDROGEOLOGICAL ANALYSIS FOR
PROPOSED INCREASED GROUNDWATER PUMPAGE
FREMONT VALLEY, CALIFORNIA

1.0 INTRODUCTION

This report summarizes the results of a hydrogeological analysis performed to determine the potential impact of a proposed increase in groundwater pumpage at Rand Mining Company (RMC) wells in northeastern Fremont Valley, California. The purpose of this analysis was to evaluate the potential impact of the proposed increased pumpage due to the Rand Project on groundwater conditions and vegetation in the vicinity of the Rand Communities Water District (RCWD) production wells.

Groundwater pumpage from RMC wells is projected to average 190 gallons per minute (gpm) during a 6-year period for currently approved mining operations (RMC, 1994b). Groundwater pumpage is projected to increase to an average of 345 gpm during a 16-year period for the Rand Project (RMC, 1994a and 1994b) (Table 1). The proposed groundwater production rate would be greatest during the first 11 years of the Rand Project, with an average pumping rate of approximately 450 gpm. The maximum average estimated production rate during this phase would be approximately 500 gpm. Groundwater production is proposed to decrease during the last 5 years, at which point the pumping rate would average 110 gpm. For the purposes of this hydrogeological analysis, the proposed annual estimates of groundwater production were assumed to be 24 hours per day, 365 days per year. In addition, it was assumed that the proposed increased groundwater production could be obtained from production well RMC-4.

The hydrogeological analysis included the following tasks:

- .. Collecting and evaluating available geologic and hydrogeologic data provided by RMC, obtained from local industries and farms, or collected from federal, state, and local agencies. Agencies contacted included the RCWD, Antelope Valley-East Kern Water Agency



(AVEK), Kern County Water Agency (KCWA), California Department of Water Resources (DWR), California Department of Mines and Geology (DMG), and U.S. Geological Survey (USGS)

- .. Estimating the extent and characteristics of the aquifer in which the RMC and RCWD production wells are completed
- .. Evaluating regional water level trends and water quality data obtained from wells in northern Fremont Valley
- .. Measuring water levels in all RMC wells and collecting groundwater samples from production well RMC-4 for comparison to water quality data obtained from other wells in northern Fremont Valley
- .. Drilling and constructing an observation well approximately 150 feet from production well RMC-4
- .. Performing a 12-hour constant discharge aquifer test of production well RMC-4 to better estimate aquifer hydraulic parameters in this area
- .. Estimating the potential effects of the projected average pumpage, with and without the Rand Project, on groundwater conditions in northern Fremont Valley using the MODFLOW numerical model code
- .. Comparing the potential effects due to RMC pumpage, with and without the Rand Project, to the effects of regional pumpage
- .. Evaluating the potential effects of the proposed increased pumpage due to the Rand Project on vegetation in northern Fremont Valley based on estimates of water level response determined from the hydrogeological analysis.



2.0 FREMONT VALLEY GROUNDWATER BASIN

Fremont Valley is a northeast-trending valley located in the northwestern portion of the Mojave Desert region of California, northeast of the town of Mojave (Figure 1). The valley is bordered by the El Paso Mountains to the northwest, the Lava Mountains to the northeast, and the Rand Mountains to the southeast. To the south and southwest, Fremont Valley is separated from Antelope Valley by low hills south and west of the towns of California City and Mojave.

The northern portion of Fremont Valley includes Koehn Lake, which is a dry lake or playa. Surface water is present along the southern limit of Koehn Lake. The remainder of Koehn Lake is typical of other dry lakes in the Mojave Desert. The portion of Fremont Valley north and east of Koehn Lake (northern Fremont Valley) extends from an elevation of approximately 1,900 feet mean sea level (msl) at the lake to approximately 2,500 feet msl along the edges of the mountain ranges. The valley terrain is typified by gently sloping alluvial fans that extend from the Rand and El Paso mountains.

Natural vegetation in Fremont Valley includes the Creosote Brush Scrub vegetation community (U.S. Department of the Interior, [USDI], 1992). Common perennial species include creosote brush, Mormon Tea, burro brush, and black brush. Salt cedar and mesquite trees, both phreatophytes, grow near the edges of the playa and at spring locations. Perennial vegetation cover is less than 25 percent in undisturbed areas (USDI, 1992). The major agricultural area in Fremont Valley is to the southwest of Koehn Lake. In addition, one farm is located along the northeastern edge of the dry lake. Alfalfa is the primary crop raised in the valley (Koehler, 1977).

Fremont Valley is part of a large drainage basin that extends approximately 1,050 square miles from the El Paso and Rand Mountains in the north to the low hills north of the town of Mojave (Neste, Brudin & Stone [NBS], 1971; Duell, 1987). Approximately 535 square miles of this drainage basin are alluvial slopes, low hills, and valley floor, including Koehn Lake. The northern portion



of Fremont Valley is approximately 200 square miles in size (Koehler, 1977; USDI, 1992). The northern portion of Fremont Valley is part of the RCWD and the southern portion is part of the AVEK Water District (Figure 1) (KCWA, 1993).

The following sections describe the geology, hydrogeology, and groundwater pumpage and recharge in northern Fremont Valley. Data for wells located in northern Fremont Valley compiled during this analysis have been summarized (Table 2). Well and fault locations are provided (Figure 2).

2.1 GEOLOGY

Northern Fremont Valley is characterized by thick Quaternary-age, alluvial sediments bordered by mountain ranges comprised of Precambrian schist, Paleozoic limestones, Mesozoic granites, and Tertiary volcanics (California Division of Mines and Geology [DMG], 1963; USDI, 1992). Based on lithologic logs of wells drilled in the northern portion of Fremont Valley, the alluvial sediments are predominantly coarse- to medium-grained sands and gravels, with occasional boulders and thin silty and clayey intervals (Koehler, 1977; RCWD, 1979; RMC, 1990 through 1994; USDI, 1992). The alluvial sediments are at least 800 feet thick toward the north-central portion of the valley at production wells RMC-1 and RMC-2, and more than 1,045 feet thick along its northwestern margin at production well RMC-4 (Koehler, 1977; RCWD, 1979; RMC, 1990 through 1994; USDI, 1992).

The Fremont Valley is located in a structurally complex region. The northern portion of the valley is cross-cut with several northeast-southwest trending faults (Figure 2). The northwestern border of the valley is the El Paso Mountain Fault. Based on the alluvial sediments encountered in production well RMC-4, this fault appears to be a predominantly normal fault with more than 1,050 feet of vertical displacement.



The Garlock Fault system also occurs along the northwestern edge of Fremont Valley (Figure 2). The Garlock Fault system is a regional, strike-slip fault system characterized predominantly by horizontal displacement (Norris and Webb, 1990). Geologic mapping of active breaks along the Garlock Fault has indicated that this fault also has had recent vertical displacements (Clark, 1973; DMG, 1976a through c; Burke, 1979).

The Cantil Valley Fault occurs in the central portion of the Fremont Valley (DMG, 1963 and 1976a through c; Clark, 1973; Jennings, 1975; Koehler, 1977; Pampeyan et al., 1988). To the southeast of Koehn Lake, the Cantil Fault is a series of closely spaced en echelon faults that appear to be a splay off the Garlock Fault system (Clark, 1973; DMG, 1976a through c; Jennings, 1975 and 1992; Pampeyan et al., 1988). To the northeast of Koehn Lake, the extent of the Cantil Valley Fault is not well documented in geologic publications. In northern Fremont Valley, the Cantil Valley Fault appears to be a "fault zone." Geologic data indicate that the fault is characterized by widely spaced en echelon ground breaks to the south of Koehn Lake, and aerial photographs indicate that lineaments extend for less than 1 mile northeast of the lake (Clark, 1973; DMG, 1976; Pampeyan et al., 1988) (Figure 2). Recently published geologic maps of Fremont Valley do not specifically identify the Cantil Valley Fault in Fremont Valley but rather indicate several faults to the northeast of Koehn Lake (Jennings, 1992).

An unnamed fault also occurs along the base of the Rand Mountains (DMG, 1963 and 1976a through c; Jennings, 1975 and 1992; Pampeyan et al., 1988). Based on gravity survey data, this fault is probably a normal fault with predominantly vertical displacements (Mabey, 1960; DMG, 1990). It is possible that this fault may be the southern extent of the Cantil Valley Fault Zone (Figure 2).



2.2 HYDROGEOLOGY

Surface water in Fremont Valley appears to be limited to the water along the southern margin of Koehn Lake. Streams are ephemeral and fed mainly by precipitation during winter storms (Koehler, 1977; DWR, 1969; USDI, 1992). In northern Fremont Valley, two springs are located along the southern flank of the El Paso Mountains. These springs were dry during a site visit conducted in June 1993. Precipitation in the Indian Wells Valley Water District is approximately 3 to 4 inches per year (KCWA, 1993). Surface runoff from precipitation in Fremont Valley has been estimated to be approximately 437 acre-feet per year (AF/yr) (Koehler, 1977).

In general, groundwater flow in the Fremont Valley groundwater basin is toward Koehn Lake (Koehler, 1977). Based on evaluation of lithologic logs of wells, groundwater appears to occur under unconfined conditions (Koehler, 1977). Aquifer materials consist of alluvial sediments comprised predominantly of coarse- to medium-grained sands and gravels. Although clayey intervals exist at depth, these units do not appear to be laterally continuous. Due to these finer-grained units in the alluvial sediments, groundwater could exist locally under semiconfined conditions.

Aquifer thickness in Fremont Valley is unknown. Lithologic logs indicate that alluvial sediments have been encountered in all wells drilled in the valley and extend to depths of at least 1,100 feet below land surface (bls) in the northern portion of the valley, 900 feet bls in the vicinity of Koehn Lake, and 400 feet bls in the southwestern portion of the valley (Koehler, 1977; RMC, 1990 through 1994; Consolidated Placer Dredging [CPD], 1994a). Based on current depths to water, estimates of aquifer thickness range from approximately 200 to 700 feet.

The El Paso Mountain Fault and the unnamed fault at the base of the Rand Mountains act as the northwestern and southeastern boundaries of the groundwater basin in northern Fremont Valley. As such, these faults are considered barriers



to groundwater movement. The influence of the Cantil and Garlock faults on groundwater flow is discussed in a subsequent section of this report.

2.3 GROUNDWATER PUMPAGE AND RECHARGE

The water supply in northern Fremont Valley is entirely from groundwater (Broadbent & Associates, 1989; USDI, 1992). Groundwater use in Fremont Valley is predominantly agricultural. The predominant groundwater pumpage in the basin occurs from numerous agricultural wells located to the southwest of Koehn Lake, whereas only minor pumpage occurs from community water supply, agricultural, and industrial wells to the northeast of the lake (Koehler, 1977). The latest published water consumption data for Fremont Valley indicate that during 1976 approximately 60,000 acre-feet of groundwater were used by livestock, agriculture, municipal pumpage, and residences (Koehler, 1977).

Documented current pumpage in the area north of Koehn Lake is estimated to be on the order of 8,500 AF/yr. This estimate includes pumpage from agricultural wells, RMC, RCWD, and CPD production wells. Current groundwater production data covers the period from 1990 through 1994. During this period, agricultural wells immediately northeast of Koehn Lake pumped approximately 8,000 AF/yr (Arciero, 1994a). This groundwater production has been primarily from agricultural well 28H01 (Figure 2).

Production from RMC wells during 1994 is estimated to be approximately 440 AF/yr (RMC, 1994b). Standard RMC pumping operations include pumping production well RMC-4 at approximately 400 to 500 gpm for 10 to 24 hours daily. This supply is periodically augmented by pumping production well RMC-3 at approximately 100 gpm and production wells RMC-1 and RMC-2 at approximately 10 gpm each.

RCWD production for water supply is approximately 65 AF/yr (RCWD, 1990 through 1993 and 1994). The RCWD wells are currently pumped at approximately



100 gpm for 10 hours daily. Production from these wells alternates monthly so that only one well is pumped at a time. The total groundwater requirement at the CPD operation is approximately 2,000 gpm (CPD, 1994b). Most of this groundwater gets recycled during the dredging operations, and only approximately 150 gpm is required for operational losses.

CPD has three currently active production wells, CPD-1, CPD-2, and CPD-4, that pump the additional required groundwater for the mining operations. Water supply from all three wells is estimated by CPD to average 150 gpm, or 245 AF/yr (CPD, 1994b). This production rate is the average operational supply and includes recovery time and time for pump and well maintenance.

Current groundwater production from the wells southwest of Koehn Lake is undocumented. Historically, the production rates from these wells was approximately 1,500 gpm (DWR, 1969; Koehler, 1977). Currently, the amount of irrigated acreage southwest of the lake is at least five times the amount of irrigated acreage northeast of the lake. Based on this, the amount of groundwater production southwest of Koehn Lake is estimated to be much greater than the groundwater production northeast of the lake.

Based on the direction of groundwater flow toward Koehn Lake and the greater amount of groundwater production southwest of Koehn Lake, the northern portion of Fremont Valley can be considered an isolated portion of the overall Fremont Valley groundwater basin. As such, this hydrogeological analysis has been restricted to the northern Fremont Valley.

Groundwater recharge in the Fremont Valley groundwater basin primarily occurs by percolation of surface runoff (DWR, 1969; Koehler, 1977). Groundwater recharge from surface runoff in the entire Fremont Valley groundwater basin has been estimated to be approximately 200 AF/yr (Koehler, 1977). Based on the size of the drainage capture areas and the size of the northern portion of the Fremont Valley compared to the entire groundwater basin, recharge due to percolation of surface runoff in the northern Fremont Valley is estimated to be approximately



50 AF/yr. The majority of this recharge appears to be concentrated in the vicinity of five large canyons located in the El Paso and Rand mountains and in the hills along the northeastern boundary of northern Fremont Valley.

Minor groundwater recharge may also occur by percolation of irrigation water in the vicinity of Koehn Lake. Based on a cultivated acreage of approximately 1,500 acres and a consumptive water use by alfalfa of approximately 4.5 AF/yr per acre, approximately 16 percent of the total groundwater pumped by agricultural wells in the southwestern portion of northern Fremont Valley could be potentially recharged to the aquifer (Arciero, 1994b; KCWA, 1993).

Groundwater recharge in the vicinity of the CPD dredging placer mine may also occur. The dredging operation is expected to operate for a 5-year period between 1994 and 1999, with one pond for mining purposes and three ponds for settling (CPD, 1994b). The amount of recharge that results from this mine is difficult to estimate because the evaporation rates are unknown and operational losses are difficult to quantify. Based on the reported surface area of the dredging and settling ponds and using twice the evaporation rate measured in the Bakersfield area, the calculated evaporation rate at the CPD operation is estimated to be approximately 6 AF/yr (Linsley et al., 1982; KCWA, 1993; CPD, 1994b). Potential recharge in this area would be the total volume of groundwater pumped minus the amount of groundwater lost during mining operations or through evaporation, and the amount retained by the unsaturated zone. Assuming 20 percent of the groundwater pumped is lost due to operation of the mine, an evaporation rate of 6 AF/year, and a specific retention of the unsaturated sediments of 5 percent, the amount of potential recharge to the aquifer in this area is approximately 183 AF/yr. This amount of potential recharge is 75 percent of the total pumpage by the three CPD wells.



3.0 RESULTS OF FIELD INVESTIGATIONS

Field investigations for this hydrogeological analysis were conducted in two phases. The first phase was completed during a site visit on June 10, 1993, and included a site reconnaissance survey, measuring water level elevations, and collecting groundwater samples from production well RMC-4. The second phase was completed during the period from May 2 through 13, 1994, and included the drilling, construction, and development of observation well OW-1 in the immediate vicinity of production well RMC-4, and conducting a 12-hour constant discharge aquifer test of production well RMC-4.

The following sections describe the methods used and the results of the field investigations conducted for this study.

3.1 WATER LEVEL MEASUREMENTS AND GROUNDWATER SAMPLING

Water levels were measured in RMC wells in June 1993 and May 1994 using an electronic water level meter. Water level elevations for these wells were calculated from a surveyed elevation of a reference point on the top of the well casing. In addition, a pumping water level was measured in production well RCWD-1 during June 1993. Water level measurements and elevation data have been summarized (Table 2).

Groundwater quality samples were collected from production well RMC-4 for analysis of routine constituents, metals, and volatile organic compounds (VOCs) using U.S. Environmental Protection Agency Method 502.2. Routine constituents include cations, anions, total dissolved solids (TDS), and the parameters electrical conductivity (EC) and pH. Groundwater samples were analyzed by BC Laboratories, Bakersfield, California. Results of groundwater sample analyses are summarized (Table 3; Appendix A).



Analytical results of groundwater samples collected from production well RMC-4 in June 1993 indicate a sodium-sulfate-type groundwater with a TDS concentration of 910 milligrams per liter (mg/l) (Table 3). These results are similar to those detected in a groundwater sample collected from production well RMC-4 in October 1990 (RMC, 1990 through 1994).

Tetrachloroethylene (PCE) and 1,1,1-trichloroethane (1,1,1-TCA) were detected in the groundwater sample collected from production well RMC-4 in June 1993 at concentrations of 0.35 and 0.62 micrograms per liter (ug/l), respectively (Appendix A). These concentrations of PCE and 1,1,1-TCA are less than their respective federal or California Maximum Contaminant Levels (MCLs) of 5 and 200 ug/l, respectively (Table 4). These concentrations were detected at less than five times their laboratory detection limits and cannot be confirmed without additional sampling. Groundwater samples collected from production well RMC-4 in October 1990 were not analyzed for VOCs.

The low concentrations of PCE and 1,1,1-TCA detected in the groundwater sample collected from production well RMC-4 in June 1993 may be associated with cleaning of well equipment prior to installation. These low PCE and 1,1,1-TCA concentrations are not considered to be representative of groundwater contamination in this portion of the northern Fremont Valley.

Iron, lead, and zinc were the only metals detected in the sample collected from production well RMC-4 in June 1993 (Appendix A). Concentrations of these metals were less than their respective federal or California MCLs (Table 4). Except for arsenic and manganese, these sample results are similar to those detected in the groundwater sample collected from production well RMC-4 in October 1990. Arsenic and manganese were detected at concentrations less than their respective MCLs in the sample collected from production well RMC-4 in October 1990.



3.2 CONSTRUCTION OF OBSERVATION WELL OW-1

Observation well OW-1 was constructed to monitor water level declines in the vicinity of production well RMC-1 and to obtain water level data during the aquifer test for analysis of aquifer hydraulic parameters. Observation well OW-1 was constructed approximately 150 feet southwest of production well RMC-4 (Figure 2). The observation well borehole was drilled using conventional mud rotary methods and a 7-7/8-inch tricone rock bit to a total depth of 1,007 feet bls. Drilling fluids consisted of bentonite and water obtained from production well RMC-4. Observation well OW-1 was drilled and constructed by Howard Pump, Inc. of Barstow, California.

The borehole was lithologically and geophysically logged to characterize subsurface hydrogeologic conditions. Drill cuttings were described using the Unified Soil Classification System, American Society of Testing and Materials (ASTM) Standard D-2488-84. After drilling was completed, the borehole was geophysically logged by Welenco, Inc. of Bakersfield, California. The geophysical logs included guard resistivity, gamma ray, and caliper logs. The lithologic and geophysical logs for observation well OW-1 have been compiled (Appendix B).

One soil sample was collected during drilling of observation well OW-1 to quantify the density and grain size of the aquifer materials. The soil sample was collected at approximately 712 feet bls. This depth was considered to be representative of the soils based on evaluation of the geophysical log of production well RMC-4. Results of the soil sample analysis are provided (Appendix A).

Evaluation of the soil sample analysis, lithologic logging of the cuttings, and geophysical logging of the borehole indicate that the alluvial soils in the vicinity of production well RMC-4 are primarily comprised of interbedded silty sandy gravel, gravelly sand, and silty sand to a depth of 1,007 feet bls, the total depth of the borehole. One finer-grained unit was encountered at a depth



of approximately 600 to 658 feet bls and consisted of sandy silt. Based on evaluation of the geophysical log, this finer-grained unit also occurs in production well RMC-4 at an approximate depth of 558 to 640 feet bls (RMC, 1990 through 1994). Evaluation of the geophysical logs for observation well OW-1 and production well RMC-4 indicate that the soils above the sandy silt are slightly coarser-grained than the sediments below the sandy silt (RMC, 1990 through 1994). A grain-size analysis of the soil sample collected at approximately 712 feet bls indicated that this zone is comprised of 22 percent silt, 28 percent gravel, and 50 percent sand.

Observation well OW-1 was constructed in a manner similar to production well RMC-4 to ensure a similar water level response in the observation well during pumping. Observation well OW-1 was constructed using 3-inch diameter, mild steel blank casing and screen. The perforated interval extends from approximately 360 to 1,000 feet bls and has a 0.05-inch slot size. Prior to installation of the well casing, drilling fluids were thinned using fresh water. After the well casing was emplaced, a filter pack consisting of No. 5 gravel was installed into the annulus of the borehole. The depth of the filter pack was checked periodically during emplacement to verify that bridging did not occur. The filter pack was emplaced to a depth of approximately 50 feet bls.

Observation well OW-1 was developed using air lifting, swabbing, and bailing methods for approximately 4 hours prior to emplacing a grout seal to land surface. Fines were removed from the borehole by air lifting. The top of the filter pack was checked prior to grouting, and additional filter pack materials were added to bring the top of the filter pack to approximately 50 feet bls. The observation well was completed by emplacing a neat cement grout seal to land surface. Observation well OW-1 was developed an additional 9 hours after the grout was emplaced and allowed to set for approximately 12 hours. The elevation of a reference point on the top of the casing was surveyed after the well was completed.



3.3 AQUIFER TESTING OF PRODUCTION WELL RMC-4

A 12-hour constant discharge aquifer test was conducted at production well RMC-4 to better estimate the hydraulic parameters of the aquifer materials in the vicinity of production well RMC-4. Aquifer testing methodology, data, and results have been summarized (Appendix C).

Pumpage of production well RMC-4 was stopped approximately 36 hours prior to the start of the aquifer test. Production well RMC-4 is equipped with a 10-stage turbine pump set at an approximate depth of 500 feet bls. The discharge rate was monitored using an in-line totalizing flow meter and checked using a stopwatch. The discharge rate during the test averaged 510 gpm and varied only 5 percent during the test duration of 736 minutes. The discharge water was transferred to RMC mining operations via a 7-mile pipeline.

Air line pressure and engine tachometer readings were monitored at regular intervals during the pumping portion of the aquifer test. The depth of the air line in production well RMC-4 was approximately 483 feet bls. This air line depth was used to calculate the approximate depth to water during testing. Air line pressures were not monitored in production well RMC-4 during the recovery portion of the test. Because the pump column pipe was not equipped with a check valve, water entered the well from the column pipe after the pump was shut off.

Water levels were measured in observation wells OW-1 and FV-1 during pumping and recovery portions of the aquifer test. Observation well FV-1 is located approximately 890 feet southwest of production well RMC-4 (Figure 2). The total depth and screened interval of observation well FV-1 is unknown. Water levels were measured in these wells at regular intervals during the aquifer test for analysis of aquifer hydraulic properties (Appendix C).



4.0 GROUNDWATER CONDITIONS

Groundwater conditions in the northern Fremont Valley have been estimated based on evaluation of published geological and hydrogeological reports; data obtained from RMC, RCWD, and industries or farms located in the northern Fremont Valley; observations made during site reconnaissance surveys; and results of groundwater sampling, observation well drilling, and aquifer testing conducted during field investigations.

The following sections describe water levels, groundwater quality, and aquifer hydraulic parameters estimated for the northern Fremont Valley groundwater basin.

4.1 WATER LEVELS

Water level data obtained during this hydrogeological analysis have been summarized (Table 2). Historical water level data in northern Fremont Valley is not well documented. Water levels in two wells, 28H01 and 8A01, were measured regularly during the period from 1953 through 1967. Water level data for the remaining wells in the northern Fremont Valley is limited. A long-term water elevation hydrograph has been prepared for representative wells in the northern Fremont Valley (Figure 3). Wells not included on this hydrograph include those with only single water level measurements that are similar to those measured in nearby wells. This hydrograph can be used to estimate long-term water level declines.

Prior to 1979, water levels in most wells declined approximately 0.5 feet per year (ft/yr). After 1979, water level declines ranged from approximately 0.5 ft/yr in production well RMC-1 to approximately 4 ft/yr in agricultural well 28H01 (Table 2; Figure 3). Water levels in production well RMC-4 have declined at a rate of approximately 5 ft/yr, whereas water levels in production



wells RCWD-1 and RCWD-2 have declined approximately 1 ft/yr and 3 ft/yr, respectively.

Current water level elevations in northern Fremont Valley range from approximately 2,311 feet msl in production well CPD-1 in the northeastern portion of the valley to 1,860 feet msl in agricultural well 28H01 in the vicinity of Koehn Lake (Figure 4). Water level elevations of approximately 2,085 feet msl measured in the vicinity of production well RMC-4 appear anomalously high for this portion of the basin.

Current water level elevations indicate that the general groundwater flow direction is to the southwest toward Koehn Lake. The gradient for the central portion of the valley ranges from 0.03 foot per foot (ft/ft) in the northeastern portion of the valley to approximately 0.004 ft/ft in the southwestern portion of the valley near Koehn Lake (Figure 4). In the immediate vicinity of production well RMC-4, groundwater flow is to the south at a gradient of approximately 0.08 ft/ft.

Water level gradient and elevation differences in the northern Fremont Valley suggest that faults or lateral differences in the hydraulic conductivity of the aquifer may control groundwater flow in the basin. Because there are no faults mapped between the RCWD production wells and the wells in the northeastern portion of the basin or any faults that appear to extend obliquely across the valley, the change in hydraulic gradient from northeast to southwest may be due to changes in hydraulic conductivity of the aquifer. The higher water level elevations and steeper hydraulic gradients in the vicinity of production wells RMC-1, RMC-2, and RMC-3 and the CPD wells may be due to lower hydraulic conductivity of the aquifer in this region. The lower hydraulic conductivity in this portion of the basin may be the result of finer-grained sediments and/or a thinner saturated aquifer thickness.

The higher water level elevations and steep hydraulic gradients in the vicinity of production well RMC-4 are probably caused by the influence of a fault



on groundwater flow. In part, the higher water level elevations in this area may be due to groundwater recharge at Goler Wash. Based on a limited surface runoff of 14 AF/yr measured at the Goler Wash gauging station (Koehler, 1977), it is unlikely that aquifer recharge from this wash exceeds 10 AF/yr. This amount of recharge is not a likely cause of the observed groundwater gradient in this area. Either the Cantil Valley Fault Zone or the Garlock Fault may potentially affect groundwater movement in this region. Either fault may act as a low-flow barrier or may result in contrasting hydraulic conductivities of the aquifer on either side of the fault. Contrasting hydraulic conductivities on either side of the fault could be due to a change in thickness of the aquifer materials and/or a change in grain size of the aquifer sediments.

Current water level data are inadequate to determine if water level differences in this area are due to either the Cantil Valley Fault Zone or the Garlock Fault. Evaluation of historical water level data, however, suggests that the Garlock Fault acts as either a low-flow boundary to groundwater movement or has caused a hydraulic conductivity contrast in the aquifer materials on either side of this structure. Water level data from wells 21A01, 12L03, and 12N01, located to the north of the Garlock Fault, are similar to the current water levels measured in the vicinity of production well RMC-4. Water level data from wells 29N01, 29M01, 32C01, and 32E01, located north of the projection of the Cantil Valley Fault Zone and south of the Garlock Fault, are similar to water level data obtained from wells in the central portion of the valley (Figure 3).

4.2 GROUNDWATER QUALITY

Groundwater quality data obtained from wells in the northern portion of the Fremont Valley are limited and have been summarized (Table 3). Inorganic water quality differences were evaluated by plotting stiff diagrams and TDS concentrations for the northern Fremont Valley wells. Stiff diagrams graphically depict the concentrations of anions and cations in groundwater. Similar types of groundwater have similar stiff diagrams. Stiff diagrams and TDS



concentrations were plotted for the most recent groundwater sample collected from wells in the northern Fremont Valley (Figure 5).

The variation in the shape of the stiff diagrams and the changes in TDS concentrations suggest that water quality differences may exist in the basin. Some of the differences in groundwater quality may be due to differences in the screened intervals of the wells sampled and the date of groundwater sampling. However, the variations in water quality indicated across the valley are moderately pronounced and appear, in part, similar to the changes in water levels previously described.

In general, stiff diagrams of groundwater samples collected from wells north of the Garlock Fault indicate a magnesium-sulfate- or sodium-magnesium-sulfate-type groundwater. This type of groundwater is different from the sodium-bicarbonate-, sodium-sulfate-, or sodium-chloride-type groundwater that is generally indicated for the remainder of the wells in the central portion of the valley. In addition, TDS concentrations in this area average approximately 1,000 mg/l. Except for in the vicinity of Koehn Lake, these TDS concentrations are also higher than concentrations observed elsewhere in the valley.

Sodium-chloride-type water is indicated for three wells west of Koehn Lake, 8A01, 3C01, and 33H01. Higher salt and TDS concentrations in these wells are probably due to their proximity to the lake.

Except for these three wells in the vicinity of Koehn Lake, the majority of groundwater samples collected from wells in the central portion of the valley indicate a sodium-bicarbonate- or sodium-sulfate-type groundwater. Slightly greater concentrations of sodium are indicated for production wells RMC-3 and CPD-3.

The differences in water quality detected in wells located in different portions of the basin suggest that the Garlock Fault may influence groundwater



flow in the basin. In general, water quality to the north of the Garlock Fault is markedly different from water quality to the south of this fault. In addition, the slight gradation in water quality from northeast to southwest are consistent with differences in aquifer characteristics across the central portion of the basin.

4.3 AQUIFER HYDRAULIC PARAMETERS

Aquifer hydraulic parameters can be estimated for the northern portion of Fremont Valley based on published pumping and lithologic data and on the results of field investigations conducted for this hydrogeological analysis. Pumping data for wells in northern Fremont Valley have been summarized (Table 2).

Based on the results of the aquifer test of production well RMC-4, transmissivity and hydraulic conductivity in the area to supply the proposed increased pumpage are estimated to be approximately 44,000 gallons per day per foot (gpd/ft) and 65 gallons per day per square foot (gpd/ft²), respectively (Appendix C). This estimate of hydraulic conductivity is based on a saturated thickness of the aquifer of 680 feet. Based on water level and groundwater quality differences among wells in northern Fremont Valley, a hydraulic conductivity of approximately 65 gpd/ft² is considered representative for the aquifer north of the Garlock Fault.

Based on the results of aquifer testing, storativity of the aquifer in this region has been calculated to be approximately 0.0004. This calculated value of storativity is believed to be low due to the short duration of the aquifer test and the typical values of unconfined aquifers comprised of sands and gravels. A storativity value of 0.0004 is typical of a semiconfined to a confined aquifer (Driscoll, 1986). Aquifer tests conducted for only few hours do not allow sufficient time for groundwater to drain vertically through the aquifer. This type of downward drainage occurs in unconfined aquifers. A delayed drainage effect is not accounted for in storativity estimates based on only several hours



of pumping and may be not be indicative of true aquifer conditions (Driscoll, 1986). The storativity of an unconfined aquifer is typically the specific yield of the aquifer materials. The specific yield of sands and gravels range from approximately 0.20 to 0.35 (Mercer et al., 1982; Driscoll, 1986). Based on this information and results of the aquifer testing, a conservative estimate of storativity of the aquifer is considered to be 0.04.

Aquifer hydraulic parameters for the remainder of the basin are based on evaluation of published data or data obtained from the RCWD and local industries in the area. Specific capacity, or well yield, data can be used to estimate the transmissivity of an aquifer. Transmissivity can be estimated by multiplying the specific capacity of a well by a factor of 1,500 for unconfined conditions or by a factor of 2,000 for confined conditions (Driscoll, 1986). For the purposes of this analysis, transmissivity was conservatively estimated by using a factor of 2,000. Evaluation of pumping data indicates that specific capacities and yield of wells in northern Fremont Valley vary.

Specific capacities of production wells RMC-1 and RMC-2 and the CPD wells in the northeastern portion of the valley average approximately 1.9 gallons per minute per foot (gpm/ft) of drawdown (Table 2). Maximum pumping rates from these wells are also generally low and range from 25 to 115 gpm. An estimate of transmissivity based on this specific capacity data is approximately 3,800 gpd/ft. A conservative estimate of hydraulic conductivity in this portion of the basin is approximately 7.5 gpd/ft^2 based on the average saturated thickness of 525 feet. These estimates are considered reasonable based on the steep groundwater gradient observed in this area.

Specific capacity data for the remaining wells in the valley are similar to or higher than the specific capacity for production well RMC-4 and are as high as 35.6 gpm/ft at agricultural well 32C01 (Table 2). Variations in aquifer hydraulic properties throughout the remainder of the basin are considered likely based on the wide range in pumping rates, screened interval thickness, and total



depth of these wells. Groundwater conditions and estimated hydraulic parameters in the northern Fremont Valley have been summarized (Table 5; Figure 6).

Specific capacity for the RCWD wells at high pumping rates is similar to the specific capacity for production well RMC-4. Specific capacity for production well RMC-4 determined during aquifer testing was approximately 14 gpm/ft. The specific capacity determined for production well RCWD-1 during test pumping at 600 gpm was approximately 15 gpm/ft (Table 2). Based on this specific capacity value for the RCWD wells, the estimated transmissivity of the aquifer in this area is estimated to be approximately 30,000 gpd/ft. The RCWD production wells are screened over approximately a 250-foot interval, which is less than the 680-foot saturated screened interval of production well RMC-4. For the RCWD wells, an estimate of hydraulic conductivity based on the thickness of the screened interval may be more representative of the aquifer. A conservative estimate of hydraulic conductivity in this portion of the northern Fremont Valley based on the thickness of the screened interval is approximately 150 gpd/ft².

The agricultural wells in the vicinity of Koehn Lake have specific capacities and pumping rates that are generally greater than wells in the remainder of the valley. Except for agricultural well 33H01, specific capacities in this portion of the basin average 32 gpm/ft. Pumping rates for all wells in this area range from 800 to 1,600 gpm. Based this average specific capacity, the transmissivity of the aquifer in this region of the valley is estimated to be at least 64,000 gpd/ft. Based on the high pumping rates of these wells, a reasonable estimate of transmissivity in this region is considered to be approximately 100,000 gpd/ft. The agricultural wells in this area have limited screened intervals of approximately 200 feet. Based on this screened interval thickness, conservative estimates of hydraulic conductivity of the aquifer range from approximately 300 to 500 gpd/ft². A conservative, reasonable estimate of hydraulic conductivity of the aquifer in this portion of the valley is considered to be 300 gpd/ft².



These estimates of aquifer hydraulic parameters for the northern Fremont Valley groundwater basin are similar to or slightly lower than previously published values. The specific yield of the aquifer has been estimated by USGS to be approximately 0.11 based on lithologic and pumpage data (Koehler, 1977). Published transmissivity estimates for the aquifer in the northern Fremont Valley range from 60,000 gpd/ft in the central and southwestern portions of the basin to 150,000 gpd/ft in the northwestern portion of the basin, north of the Cantil Valley Fault Zone and the Garlock Fault (Koehler, 1977).



5.0 MODELING RESULTS

Numerical models were used to project water level responses and groundwater quality changes in northern Fremont Valley due to the proposed increased pumpage associated with the Rand Project. Water level responses were projected using the MODFLOW groundwater flow model code. The PATH3D particle tracking model code was used to simulate the effects of RMC pumpage on groundwater quality in the basin. A description of the numerical modeling performed for this hydrogeological analysis has been prepared (Appendix D).

To evaluate the potential effects of the increased pumpage due to the proposed Rand Project, the following four model cases were considered:

- .. Case 1 was defined as production well RMC-4 pumping alone, without the increased pumpage due to the Rand Project. In this model case, RMC pumpage ceases after 6 years.
- .. Case 2 was defined as production well RMC-4 pumping alone, with the increased pumpage due to the Rand Project. In this model case, RMC pumpage ceases after 16 years.
- .. Case 3 was defined as production well RMC-4 and regional wells pumping, without the increased pumpage due to the Rand Project. As in Case 1, RMC pumpage ceases after 6 years, while regional pumpage continues for 16 years.
- .. Case 4 was defined as production well RMC-4 and regional wells pumping, with the increased pumpage due to the Rand Project. In this model case, RMC and regional pumpage both continue for 16 years.

These model cases were developed to simulate the water level responses for different pumping conditions in northern Fremont Valley. For each model case, aquifer parameters were kept constant and only pumping conditions were varied.



In all model cases, pumping rates for production well RMC-4 were based on RMC's average projected groundwater production rates, both with and without the proposed increased pumpage due to the Rand Project (Table 1).

Pumping rates for regional wells were based on known or projected pumping patterns and were assumed to continue for 16 years unless otherwise documented (Appendix D). Pumpage from CPD production wells CPD-1, CPD-2, and CPD-4 was varied to account for continued mining operations until 1999 and to account for recharge from the surface holding ponds to the groundwater table. Pumpage from each of the three CPD production wells was assumed to be 50 gpm for the first 2 years of the model. After 2 years, pumpage from these wells was decreased to 12 gpm to account for recharge to the groundwater table. Although pumpage from the CPD wells ceased after the fifth year of the model, recharge in this vicinity was continued for another 3 years to account for delayed recharge to the groundwater table.

Pumpage from the RCWD and agricultural wells was assumed to be steady throughout the model simulation. The current agricultural pumpage of 8,000 AF/yr was equally distributed among six irrigation wells. To account for recharge due to irrigation return flows, the pumpage for these wells was reduced by 16 percent. The pumpage from each of the six agricultural wells was assumed to be 698 gpm for the duration of the model simulation. Pumpage from the RCWD production wells was based on the current total production of 65 AF/yr. This pumpage was distributed equally, and each well was assumed to pump at 21 gpm throughout the model simulation.

Water level responses due to the increased pumpage were evaluated using all four model cases. The model simulations were performed using a flat water table as the initial condition (Appendix D). This model incorporated the variation in hydraulic conductivity of the aquifer sediments in the four regions previously described (Section 4.3; Figure 6). A uniform storativity value of 0.04 was used for the model, based on the results of the aquifer test, the lithologies of the aquifer materials, and previously published values. A uniform 500-foot thickness



of the aquifer sediments was selected for the model, based on the average documented thickness of the saturated sediments in the basin (Table 2). The model also incorporated recharge due to irrigation, CPD mining practices, and precipitation. To determine the sensitivity of the model results to variations in the model parameters, a sensitivity analysis was performed by varying hydraulic conductivity and storativity of the aquifer (Appendix D).

Each model case simulation was run for a 16-year pumping period, and projected drawdowns were plotted at the 6-, 12-, and 16-year time steps. The 6-year time step represents the end of RMC pumpage without the proposed Rand Project. The 12-year time step represents the end of the maximum RMC pumpage associated with the proposed Rand Project. Except in the vicinity of production well RMC-4, the model results from the 12-year time step approximate the greatest drawdowns caused by the proposed increase in pumpage. In the vicinity of production well RMC-4, the greatest drawdowns would occur after 11 years due to the decrease in the proposed pumpage schedule for the Rand Project. The 16-year time step represents the end of RMC pumpage after completion of the proposed Rand Project. The projected water level drawdown in the vicinity of production well RMC-4 and water level declines in the vicinity of the RCWD production wells, the CPD production wells, and the agricultural wells after 6-, 12-, and 16-year pumping periods have been summarized (Table 6; Appendix D).

The following sections describe the projected water level responses and changes in groundwater quality determined using the numerical model.

5.1 WATER LEVEL RESPONSE

Water level drawdowns have been projected for the northern Fremont Valley after 6- and 16-year periods for each model case (Figures 7 through 14). After 6 years, RMC pumpage ceases for Cases 1 and 3 (Figures 7 and 11). After 16 years, RMC pumpage ceases for Cases 2 and 4 (Figures 10 and 14). Projected drawdown results for all time steps have been provided (Appendix D). The amount



of estimated water level decline across northern Fremont Valley for Cases 3 and 4 has been used to project water table elevations in northern Fremont Valley (Figures 15 and 16).

The following sections describe the projected water level response for the four model cases performed for this analysis.

5.1.1 Case 1: Production Well RMC-4 Pumping Alone, Without the Rand Project

Based on the model results, projected water level drawdowns for this case range from approximately 3 feet in the vicinity of production well RMC-4 to approximately 0.5 foot in the vicinity of Koehn Lake after a 6-year pumping period (Figure 7). The water level gradient caused by the drawdown in the northeastern region would be steeper due to the lower estimated hydraulic conductivity of the aquifer. In the vicinity of the RCWD wells, water level declines are projected to be approximately 1.3 feet (Table 6).

After a 16-year pumping period, water levels would almost completely recover throughout northern Fremont Valley, and very little water level decline is projected (Table 6; Figure 8; Appendix D).

5.1.2 Case 2: Production Well RMC-4 Pumping Alone, With the Rand Project

Based on the model results, projected water level drawdown after a 6-year pumping period in the vicinity of production well RMC-4 is approximately 19.6 feet (Table 6). As in Case 1, only a slight amount of water level decline is projected in the northeastern portion of the basin (Figure 9). In the vicinity of the RCWD production wells, the water level decline after 6 years is projected to be approximately 4.7 feet.



The maximum water level declines in the basin for this model case can be approximated by the results of the 12-year pumping period (Table 6). At the end of this pumping period, the drawdown in the vicinity of production well RMC-4 is estimated to be approximately 15.1 feet. This value is less than the estimated drawdown after 6 years of pumping because the projected average pumping rate would decrease slightly during Year 12 of the model (Table 1). The projected maximum amount of drawdown in the vicinity of production well RMC-4 is estimated to be approximately 20 feet and would occur after 11 years. The projected water level declines after 12 years of pumping in the remainder of the basin approximate the maximum amount of drawdown caused by the proposed Rand Project pumpage. Projected water level declines in the vicinity of the RCWD production wells and Koehn Lake are approximately 5.8 and 2.2 feet, respectively (Table 6).

After a 16-year pumping period, the projected water level drawdowns have slightly recovered throughout northern Fremont Valley (Figure 10). As in Case 1, an area of residual drawdown has been projected in the northeastern portion of the basin. Projected water level declines in the basin range from approximately 5.3 feet in the vicinity of production well RMC-4 to approximately 2.2 feet in the vicinity of Koehn Lake (Table 6). In the vicinity of the RCWD production wells, drawdown after 16 years is estimated to be approximately 4.1 feet.

5.1.3 Case 3: Production Well RMC-4 and Regional Wells Pumping, Without the Rand Project

Based on the model results, water level response in the basin after a 6-year pumping period is dominated by one area of drawdown localized at the agricultural wells in the southwestern portion of the basin (Figure 11). Water level drawdown in the vicinity of production well RMC-4 for this model case after 6 years is projected to be approximately 21.9 feet (Table 6). Projected water level declines in the basin range from approximately 23.7 feet in the vicinity of the RCWD production wells to approximately 20 feet in the vicinity of Koehn Lake. The maximum water level decline in the basin for this pumping period is



projected to be approximately 34.6 feet in the vicinity of the agricultural wells near Koehn Lake. As in Case 1 and Case 2, the projected water level decline is less in the northeastern region due to the lower estimated hydraulic conductivity of the aquifer. Due to continued recharge after the CPD production wells cease pumping, water levels are projected to rise approximately 12 feet in this area.

After a 16-year pumping period, water level response in the basin is dominated by the pumpage of the agricultural wells in the southwest (Figure 12). Projected water level declines in this region are approximately 51.8 feet (Table 6). Projected water level declines after 16 years of regional pumpage in the vicinity of production well RMC-4 and the RCWD production wells are approximately 41.7 and 44.4 feet, respectively.

Water table elevations for the northern Fremont Valley groundwater basin have been prepared based on the water level declines projected after 16 years of pumping for Case 3 (Figure 15). Projected water level elevations indicate that groundwater gradients throughout the basin are toward the agricultural center in the southwestern portion of the basin. Except for lower elevations, the projected water table gradients are similar to those measured in May 1994 (Figure 4).

5.1.4 Case 4: Production Well RMC-4 and Regional Wells Pumping, With the Rand Project

Based on the model results, projected water level response in the basin after a 6-year pumping record indicates two areas of drawdown: one localized at production well RMC-4 and the other in the vicinity of the agricultural wells in the southwest (Figure 13). Water level drawdown in the vicinity of production well RMC-4 is projected to be approximately 39.2 feet (Table 6). Projected water level declines in the basin range from 27.1 feet in the vicinity of the RCWD production wells to approximately 35.8 feet in the vicinity of the agricultural wells. Water levels are projected to rise approximately 12 feet in the vicinity



of the CPD production wells due to continued recharge after the production wells cease pumping.

For this model case, the maximum water level decline in the vicinity of production well RMC-4 can be approximated using the results of the 12-year pumping period. As in Case 2, the maximum projected water level decline in the vicinity of production well RMC-4 is estimated to occur at the end of Year 11 when RMC pumpage for the Rand Project decreases. For Case 4, which includes regional pumpage, the maximum projected water level decline in the vicinity of production well RMC-4 is approximately 50.6 feet. Unlike in Case 2, however, the projected water level declines in Case 4 for the remainder of the basin at the end of a 12-year pumping period are not the maximum projected amounts due to the effects of regional pumpage. The maximum projected water level decline for wells other than production well RMC-4 occur after 16 years of pumping.

After a 16-year period, the water level response in the basin is dominated by pumpage of the agricultural wells in the southwest (Figure 14). The projected water level declines in the vicinity of the RCWD production wells and the agricultural wells are approximately 48.4 and 54.6 feet, respectively (Table 6). The projected drawdown in the vicinity of production well RMC-4 after 16 years is approximately 47.1 feet. As in the other model cases, the projected water level gradient in the northeast is steep due to its lower estimated hydraulic conductivity (Figure 14).

Water table elevations for the northern Fremont Valley groundwater basin have been estimated based on the water level declines projected after 16 years of pumping (Figure 16). The projected water table elevations for this case include the proposed additional pumpage associated with the Rand Project. Except for slightly lower elevations, the projected groundwater gradients from Case 4 model results are similar to those projected for Case 3 (Figure 15).



5.1.5 Additional Water Level Declines Due to the Rand Project

The difference in projected water level responses for the model cases with and without the pumpage associated with the Rand Project can be used to evaluate the potential effects of the proposed increased pumpage. The difference between Case 1 and Case 2 model results indicates the additional water level declines if only production well RMC-4 is pumping. Similarly, the difference between Case 3 and Case 4 results indicates the additional water level declines if all wells are pumping.

Based on the model results, the difference in projected drawdowns is illustrated in a cross section of the projected drawdown cones caused by production well RMC-4 pumping alone (Figure 17). This cross section was prepared based on the model results for Cases 1 and 2 after 6 years of pumping. The cross section of projected drawdown illustrates that the drawdown caused by production well RMC-4 is greatest near the pumping well and that drawdown decreases rapidly away from the well. The difference in the drawdown cones indicates the amount of additional drawdown caused by the increased pumpage due to the Rand Project.

Based on a comparison of the model results, the additional drawdown due to the increased Rand Project pumpage is similar whether only production well RMC-4 is pumping or whether all wells are pumping. After 6 years, the additional projected drawdown due to the Rand Project is approximately 17 feet in the vicinity of production well RMC-4 (Table 6). In the vicinity of the RCWD production wells, approximately 3 feet of additional water level decline is projected after 6 years of pumping.

After 16 years of pumping, the additional projected drawdown due to the Rand Project pumpage is approximately 5 feet in the vicinity of production well RMC-4 (Table 6). In the vicinity of the RCWD production wells, approximately 4 feet of additional water level decline is projected after 16 years of pumping.



The maximum additional drawdown in the vicinity of production well RMC-4 is projected to be approximately 17 feet. The maximum additional water level decline in the vicinity of the RCWD production wells is projected to be approximately 6 feet.

5.2 GROUNDWATER QUALITY CHANGES

The PATH3D particle tracking model code was used to assess the possible effects of the proposed increased pumpage from production well RMC-4 on groundwater quality in the vicinity of the RCWD wells. For the purposes of this hydrogeological analysis, PATH3D was used to estimate the amount of possible movement of a contour line representing the 500 mg/l TDS concentration contour in response to the proposed increased pumpage due to the Rand Project.

Preliminary calculations to determine the extent of movement of a particle in flow field with the amount of regional pumpage estimated for the basin indicate that the contour might be expected to move only approximately 500 feet with all wells pumping. Based on these preliminary estimates, one simulation was completed using model Case 4 to maximize any potential effects on water quality. This simulation was performed using regional pumpage and the pumpage associated with the Rand Project.

The results of this model simulation indicate that the amount of estimated migration of the 500 mg/l TDS contour is minor (Figure 18). No discernable migration of the contour in the northeastern portion of the basin was observed in the model simulation results. This may be due to the lower estimated hydraulic conductivity of the aquifer in this region. The model results indicate that the contour may migrate on the order of 1,000 feet in a northerly and westerly direction away from the RCWD production wells toward the agricultural wells and production well RMC-4 after 16 years of regional pumping. The PATH3D model did not address vertical changes in groundwater quality of the basin. The



available groundwater quality data is too limited to evaluate if groundwater quality changes with depth in the valley.

5.3 DISCUSSION

The MODFLOW model allows variable pumping rates for both production well RMC-4 and regional wells, incorporates basin boundaries and recharge of the aquifer, and allows variation in the aquifer hydraulic parameters across the basin (Appendix D). The simulations performed for this analysis used a conservative approach by estimating drawdowns assuming an initial flat water table condition. This approach is considered conservative because production well RMC-4 is located upgradient of the RCWD wells. Since groundwater flow in northern Fremont Valley is toward the southwest where the RCWD production wells are located, any pumpage of production well RMC-4 would tend to decrease the groundwater gradient in this area but not reverse it. By assuming a flat water table as the initial condition, projected drawdowns caused by pumping production well RMC-4 are greater than if the drawdowns were projected using a sloping water table condition. In addition, historical water level and pumping data were insufficient to allow for model calibration required to project drawdowns using a sloping water table condition.

The drawdown projections for Case 3 and Case 4, which are based on RMC and regional pumpage, are more uncertain than those for Case 1 and Case 2, which are based only on pumpage from production well RMC-4. The uncertainties associated with the modeling results based on RMC and regional pumpage include projection of current pumping rates for 16 years, the magnitude and potential effect of increased well pumpage to the southwest of Koehn Lake, the variation in hydraulic parameters across the basin, and recharge associated with agricultural activities, CPD mining, and precipitation.

Recent regional water level data are limited (Table 1). Based on limited available data, water levels have declined at a rate of approximately 0.5 ft/yr



in the northeastern portion of the basin, 5 ft/yr north of the Garlock Fault, and from 1 to 4 ft/yr in the central and southwestern portions of the basin (Table 2). Using an average water level decline of 3 ft/yr throughout the entire basin, it is estimated that water levels will decline approximately 48 feet after 16 years. This amount of water level decline is similar to the amount projected in the southwestern portion of the basin using the MODFLOW model (Table 6). Although the model results appear reasonable based on this analysis, this assumes that the current pumping rates and total groundwater production from the agricultural wells and the RCWD production wells remain constant during the next 16 years.

The southwestern boundary of the model is near the edge of Koehn Lake. The model assumed that a constant water level could be maintained at the approximate position of the surface water of the lake, approximately 17,000 feet farther southwest. This approach was used because surface water has been observed in Koehn Lake during recent years. However, if pumping were to increase southwest of the lake, this condition may not be valid. If pumping were to increase from wells southwest of Koehn Lake, the drawdown estimates in the northern Fremont Valley are likely to increase.

Although evaluation of the available geologic and hydrogeologic data indicates that aquifer hydraulic parameters vary across the basin, the values of hydraulic conductivity used for the model should be considered approximate within a factor of two. The estimates were primarily based on data that vary as a result of changes in hydraulic conductivity, not on actual field testing results. As such, there is inherent uncertainty associated with using the estimated values of hydraulic conductivity.

Projected drawdowns based on model simulations for Cases 1 and 2 with production well RMC-4 pumping alone are based on more reliable pumping projections over the next 16 years (Table 1). Although the projected drawdowns for these model cases still incorporate some uncertainty in the variation of hydraulic conductivity across the basin, they do not include the uncertainties



associated with regional pumpage. Because production well RMC-4 is located in the northwestern portion of the basin, the potential effects of increased pumpage southwest of Koehn Lake are minimized. For these reasons, the drawdown estimates for Case 1 and Case 2, which are based on production well RMC-4 pumping alone, are considered the most reasonable to evaluate the potential effects of the proposed increased pumpage.

The PATH3D model results are considered reasonable based on the available data. Because current water quality data are limited from wells in northern Fremont Valley, however, the position of the TDS concentration contours in the basin is uncertain. The PATH3D model did not address vertical changes in water quality of the basin. The available water quality data are too limited to evaluate if water quality changes with depth in the valley.



6.0 POTENTIAL IMPACTS OF PROPOSED INCREASED GROUNDWATER PUMPAGE

The potential effects of the increased pumpage of production well RMC-4 on water levels, vegetation, and groundwater quality in northern Fremont Valley were evaluated based on the modeling results.

Case 1 and Case 3 model simulations were performed to evaluate the water level response of pumpage without the proposed Rand Project. The results of these model simulations were compared to the results of Case 2 and Case 4 model simulations, respectively. Case 2 and Case 4 model results represent the effect of the proposed increased pumpage due to the Rand Project.

For Case 2, which was based on production well RMC-4 pumping alone, the total projected maximum water level decline in the vicinity of the production well RMC-4 due to the proposed increased pumpage of production well RMC-4 is approximately 20 feet after 11 years. For Case 4, which was based on production well RMC-4 and regional pumping, the total projected maximum water level decline in the vicinity of production well RMC-4 is approximately 51 feet after 11 years. The amount of additional water level decline due to the increased pumpage of production well RMC-4 projected at the end of 11 years is approximately 16 feet of the total 51 feet.

For Case 2, which was based on production well RMC-4 pumping alone, the total projected maximum water level decline in the vicinity of the RCWD production wells due to the proposed increased pumpage of production well RMC-4 is approximately 6 feet after 12 years (Table 6). For Case 4, which was based on production well RMC-4 and regional pumping, the total projected maximum water level decline in the vicinity of these wells is approximately 48 feet after 16 years. The amount of additional water level decline due to the increased pumpage of production well RMC-4 projected at the end of 16 years is approximately 4 feet of the total 48 feet.



The potential effects of water level declines on production wells include reduced well yield due to dewatering of aquifer material and pumping water levels falling below the level of the pump. Production well RCWD-2 is screened between 452 and 590 feet bls and production well RCWD-1 is screened between 300 and 547 feet bls (Table 2). The approximate pumping depth to water for both wells was 378 feet bls in May 1994 (RCWD, 1990 through 1993 and 1994). Thus, the current thickness of saturated aquifer materials above the top of the screened interval in production well RCWD-2 during pumping is approximately 70 feet. The saturated interval in production well RCWD-1 is approximately 170 feet. Although a regional water level decline of approximately 48 feet projected by the modeling may effect groundwater production at these wells by reducing the saturated thickness of the aquifer, a potential increase of 4 to 6 feet caused by the proposed Rand Project does not represent a significant portion of this decline.

Based on the depth of groundwater in Fremont Valley, the projected water level declines due to RMC pumpage are not expected to impact the naturally occurring vegetation in the valley. Most of the natural vegetation belongs to the Creosote Brush Scrub community, which is characterized by limited surficial root systems that do not rely on groundwater sources (USDI, 1993).

Regional water level declines may affect vegetation in the valley that does rely on groundwater sources. A few phreatophyte species were observed at springs and along the margin of Koehn Lake during the site visit conducted as part of this analysis. These species have root systems that extend to the water table. The springs in Fremont Valley appear to be located near geologic structures (DMG, 1963). Mesquite brush and salt cedar trees occur in sporadic clusters at the springs or along the margin of the dry lake.

For Case 2, which was based on production well RMC-4 pumping alone, the total projected maximum water level decline in the vicinity of Koehn Lake due to the proposed increased pumpage of production well RMC-4 is approximately 2 feet after 16 years (Table 6). For Case 4, which was based on production well RMC-4 and regional pumping, the total projected maximum water level decline in the



vicinity of the lake is approximately 34 feet after 16 years (Table 6). The amount that water levels are projected to additionally decline due to the increased pumpage of production well RMC-4 at the end of 16 years is approximately 1 to 2 feet (Table 6). Additional water level declines due to the proposed increased pumpage are not likely to affect phreatophyte vegetation near the springs or along the margin of Koehn Lake. If regional pumping trends continue, however, the projected amount of water level decline in the basin may affect the phreatophyte vegetation in northern Fremont Valley.

The potential effect of the proposed increased pumpage on the groundwater quality in the basin is considered to be minor. Based on the modeling results, the 500 mg/l TDS contour may migrate on the order of 1,000 feet in a northerly and westerly direction away from the RCWD production wells. This result would not adversely affect the groundwater quality in the vicinity of the RCWD production wells. The modeling approach used for this analysis did not address vertical changes in groundwater quality of the basin due to the lack of available data.



7.0 CONCLUSIONS

Based on the results of the MODFLOW model simulations performed for this hydrogeological analysis, the impacts associated with the proposed increased pumpage due to the Rand Project have been quantified using the differences in drawdown projected for Case 1 and Case 2. The proposed increased pumpage would result in approximately 5 feet of additional water level decline in the vicinity of production well RMC-4 and 4 feet of additional water level decline in the vicinity of the RCWD production wells after a 16-year period. The projected maximum additional water level decline caused by the proposed increase in RMC pumpage is approximately 17 feet in the vicinity of production well RMC-4. The projected maximum additional water level decline in the vicinity of the RCWD production wells is approximately 6 feet.

The potential effects of water level declines on a production well include reduced well yield due to dewatering of aquifer material and pumping water levels falling below the level of the pump. The projected additional increase in water level decline of 4 to 6 feet in the vicinity of the RCWD production wells is not likely to significantly reduce the saturated thickness of the aquifer in the vicinity of the RCWD production wells. Based on this analysis, the increased pumpage of production well RMC-4 is not likely to adversely impact the RCWD's ability to supply water from existing production wells.

Based on the depth of groundwater in Fremont Valley, the estimated water level declines due to RMC pumpage are not expected to impact the naturally occurring vegetation in the valley. The vegetation in the valley that depends on groundwater are mesquite and salt cedar trees located at springs or along the margin of Koehn Lake. Additional water level declines on the order of 1 to 2 feet across the entire basin due to increased RMC pumpage are not likely to significantly impact the phreatophyte vegetation near the springs or along the margin of Koehn Lake. If, however, the regional pumping trends identified during this analysis continue, the projected amount of water level decline in the basin may affect the phreatophyte vegetation in northern Fremont Valley.



The impact of the proposed increased pumpage on groundwater quality in the basin is considered to be minor. Based on the modeling results, the potential effect of the proposed increase in RMC pumpage due to the Rand Project would not adversely affect groundwater quality in the vicinity of the RCWD production wells. The impact of the proposed increased pumpage on the vertical changes to groundwater quality in the basin were not addressed due to the limited water quality data available for this analysis.

Based on the hydrogeologic analysis performed, the increased pumpage of production well RMC-4 due to the proposed Rand Project is not likely to significantly impact water levels, groundwater quality, or natural vegetation in northern Fremont Valley. In particular, the increase in water level decline projected in the vicinity of the RCWD production wells due to the proposed Rand Project pumpage is not expected to significantly impact the groundwater quality or water supply of these wells. Based on this hydrogeological analysis, no changes are recommended to the proposed plan for increasing pumpage at production well RMC-4.





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TABLE 1

PROJECTED GROUNDWATER PRODUCTION
RAND MINING COMPANY

YEAR	WITHOUT RAND PROJECT.....		WITH RAND PROJECT.....		INCREMENTAL DIFFERENCE.....	
	<u>ACRE-FEET</u>	<u>GALLONS PER MINUTE(a)</u>	<u>ACRE-FEET</u>	<u>GALLONS PER MINUTE(a)</u>	<u>ACRE-FEET</u>	<u>GALLONS PER MINUTE(a)</u>
1995	677	420	679	421	2	1
1996	674	418	754	467	80	50
1997	128	79	762	472	634	393
1998	128	79	774	480	645	400
1999	128	79	800	496	671	416
2000	71	44	737	457	666	413
2001	0	0	738	458	738	458
2002	0	0	702	435	702	435
2003	0	0	666	413	666	413
2004	0	0	666	413	666	413
2005	0	0	666	413	666	413
2006	0	0	437	271	437	271
2007	0	0	142	88	142	88
2008	0	0	142	88	142	88
2009	0	0	142	88	142	88
2010	0	0	41	25	41	25

SOURCES: Rand Mining Company, 1994a and 1994b

(a) Assumes 24-hour per day pumping, 365 days per year.



HARGIS + ASSOCIATES, INC.

TABLE 2

WELL DATA
NORTHERN FREMONT VALLEY

WELL IDENTIFIER	OWNER/ USER	LAND SURFACE ELEVATION (feet msl)	WELL DIAMETER (inches)	TOTAL DEPTH (feet b1s)	SCREENED INTERVAL (feet b1s)	DATE MEASURED	STATIC DEPTH TO WATER (feet b1s)	WATER LEVEL ELEVATION (feet msl)	PUMPING RATE (gpm)	DRAWDOWN (feet)	SPECIFIC CAPACITY (gpm/ft)	SOURCE OF DATA
<u>T29S/R39E:</u>												
12L01	RMC	2,558	10	101	NR	05/94	dry	>2,457				A, B
12L02	RMC	2,558	10	350	NR	10/17	460	2,098	65			A
12L03	RMC	2,510	12	516	NR	02/58	dry	>2,208				A
						10/17	440	2,070	65			A
						05/58	392	2,118				A
						05/94	dry	>1,994				B
12N01	NR	2,395	16	520	NR	02/58	397	1,998				A
FV-1	NR	2,399	NR	NR	NR	05/94	320	2,079				B
OW-1	RMC	2,415	3	1,007	360-1,000	05/94	333	2,082				B
RMC-4	RMC	2,421	10	1,045	360-1,006	07/90	309(a)	2,112(a)	540	24	22.5	C
						08/90	306(a)	2,115(a)				C
						05/92	316(a)	2,105(a)				C
						08/92	312(a)	2,109(a)	360	81.5	19.5	C
						02/93	314(a)	2,107(a)				C
						05/93	317(a)	2,104(a)				C
						08/93	321(a)	2,100(a)				C
						11/93	324(a)	2,097(a)				C
						02/94	319(a)	2,102(a)				C
						04/94	324(a)	2,097(a)	520	26	20.0	C
						05/94	326(a)	2,095(a)	510	37	13.8	B

NOTE: Refer to page 6 of this table for footnotes



HARGIS + ASSOCIATES, INC.



TABLE 2 (continued)
WELL DATA
NORTHERN FREMONT VALLEY
Page 2 of 6

WELL IDENTIFIER	OWNER/ USER	LAND SURFACE ELEVATION (feet msl)	WELL DIAMETER (inches)	TOTAL DEPTH (feet b/s)	SCREENED INTERVAL (feet b/s)	DATE MEASURED	STATIC DEPTH TO WATER (feet b/s)	WATER LEVEL ELEVATION (feet msl)	PUMPING RATE (gpm)	DRAWDOWN (feet)	SPECIFIC CAPACITY (gpm/ft)	SOURCE OF DATA
<u>T29S/R39E (continued):</u>												
15M01	(Miller)	2,295	60	80	NR	02/58	64	2,231				
						04/60	65	2,230				
21A01	(Austin)	2,165	8	103	NR	02/58	46	2,119				A
RCWD-1	RCWD	2,280	14	600	300-547	02/58	NR	NR	600		15.0	A, D
						07/54	350	1,930				D
						1971	350	1,930		10		D
						12/78	358	1,922	186	4.8	38.8	C
						06/93	375(b)	1,905(b)	122			B
						04/94	375	1,905	100	3	33.3	F
RCWD-2	RCWD	2,280	12	600	452-590	10/79	333	1,947	500			E
						06/91	334(c)	1,946(c)				
						06/92	340(c)	1,940(c)				
						06/93	351(c)	1,929(c)	122			E, B
						04/94	375	1,905	100	3	33.3	F
26A01	(Prather)	2,270	10	244	NR	02/58	138	2,132				A
28H01	Arciero	2,100	12	500	NR	04/53	173	1,927				A, G
						03/54	173	1,927				A
						03/55	174	1,926				A
						03/56	174	1,926				A
						03/57	174	1,926				A
						02/58	175	1,925				A

NOTE: Refer to page 6 of this table for footnotes



HARGIS + ASSOCIATES, INC.

TABLE 2 (continued)
WELL DATA
NORTHERN FREMONT VALLEY
Page 3 of 6

WELL IDENTIFIER	OWNER/USER	LAND SURFACE ELEVATION (feet msl)	WELL DIAMETER (inches)	TOTAL DEPTH (feet b/s)	SCREENED INTERVAL (feet b/s)	DATE MEASURED	STATIC DEPTH TO WATER (feet b/s)	WATER LEVEL ELEVATION (feet msl)	PUMPING RATE (gpm)	DRAWDOWN (feet)	SPECIFIC CAPACITY (gpm/ft)	SOURCE OF DATA
T29S/R39E (continued):												
29M01	(Morris)	1,980	14	265	NR	02/94	240	1,860	1,000			G
						02/67	69	1,911	800	28	28.6	A, H
29N01	(Wirtz)	1,980	8	165	NR	02/58	66	1,914	350			A
32C01	(Wirtz)	1,990	14	NR	NR	11/49	78	1,910				A
						04/53	79	1,911				A
						10/56	76	1,908				A
						02/58	79	1,911	1,164			A
32E01	(Jones)	1,965	6	125	NR	02/58	54	1,911				A
33H01	(Stockton)	2,095	16	460	NR	02/58	177	1,918	1,100	225	4.9	A
						08/78	180	1,915				D

NOTE: Refer to page 6 of this table for footnotes



HARGIS + ASSOCIATES, INC.

TABLE 2 (continued)
WELL DATA
NORTHERN FREMONT VALLEY
Page 4 of 6

WELL IDENTIFIER	OWNER/USER	LAND SURFACE ELEVATION (feet msl)	WELL DIAMETER (inches)	TOTAL DEPTH (feet b/s)	SCREENED INTERVAL (feet b/s)	DATE MEASURED	STATIC DEPTH TO WATER (feet b/s)	WATER LEVEL ELEVATION (feet msl)	PUMPING RATE (gpm)	DRAWDOWN (feet)	SPECIFIC CAPACITY (gpm/ft)	SOURCE OF DATA
<u>T29S/R39E (continued):</u>												
33K01	(Stockton)	2,050	16	403	NR	02/58	131	1,919				A
						08/78	130	1,920				D
<u>T29S/R40E:</u>												
NR	(Boral)	2,780	12	650	NR	10/92	560	2,220	35			I
21H01	NR	2,780	12	352	NR	NR	NR	NR				A
21M01	(Adams)	2,680	16	900	NR	08/78	700	1,980	125			D
RMC-1	RMC	2,684	16	838	516-838	08/75	518	2,166	125	217	0.6	C
						08/85	516	2,168	100			C
						02/86	526	2,158				C
						05/94	523	2,161				B
RMC-2	RMC	2,684	10	800	600-800	07/87	600(d)	2,084(d)	25			C
						05/94	527	2,157				B
RMC-3	RMC	2,423	14	770	540-770	01/90	453	1,970	130	32	4.1	C
						05/92	541(e)	1,882(e)	112	142	0.9	C
						10/92	509(e)	1,914(e)				C
						05/94	453	1,970				B
CPD-1	CPD	2,620	16	840	350-810	09/93	509	2,311	60			J
						05/94	540(f)	2,280(f)				B
CPD-2	CPD	2,782	18	800	350-770	09/93	548	2,234	90			J
CPD-3	CPD	2,840	14	860	NR	01/42	396	2,444	94	31	3.0	A

NOTE: Refer to page 6 of this table for footnotes



HARGIS + ASSOCIATES, INC.

TABLE 2 (continued)
WELL DATA
NORTHERN FREMONT VALLEY
Page 5 of 6

WELL IDENTIFIER	OWNER/ USER	LAND SURFACE ELEVATION (feet msl)	WELL DIAMETER (inches)	TOTAL DEPTH (feet b1s)	SCREENED INTERVAL (feet b1s)	DATE MEASURED	STATIC DEPTH TO WATER (feet b1s)	WATER LEVEL ELEVATION (feet msl)	PUMPING RATE (gpm)	DRAWDOWN (feet)	SPECIFIC CAPACITY (gpm/ft)	SOURCE OF DATA
<u>T29S/R40E (continued):</u>												
CPD-4	CPD	2,800	10	1,100	470-1,000	09/93	573	2,227	117	128	0.9	J
3C01	(Stockton)	2,160	14	610	NR	02/58	237	1,923	1,600	45	35.6	A
8A01	NR	2,050	12	268	NR	08/78	240	1,920				D
						04/53	137	1,913				A
						03/55	137	1,913				A
						03/56	137	1,913				A
						03/57	138	1,912				A
						02/58	138	1,912				A
						03/59	138	1,912				A
						02/60	140	1,910				A
						02/61	140	1,910				A
						03/62	140	1,910				A
						03/63	140	1,910				A
						03/64	140	1,910				A
						03/65	140	1,910				A
						03/66	140	1,910				A
						04/67	142	1,908				A

NOTE: Refer to page 6 of this table for footnotes



HARGIS + ASSOCIATES, INC.

TABLE 2 (continued)
WELL DATA
NORTHERN FREMONT VALLEY
Page 6 of 6

FOOTNOTES

SOURCES: A = California Department of Water Resources, 1969
B = Hargis + Associates, Inc. field investigations, 1993 and 1994
C = Rand Mining Company, 1990 through 1994
D = Kreiger & Stewart, 1978
E = Rand Communities Water District, 1990 through 1993
F = Rand Communities Water District, 1994
G = Arciero, 1994a and b
H = Neste, Brudin & Stone, 1971
I = Boral Resources, Inc., 1994
J = Consolidated Placer Dredging, Inc., 1994a and b

(a) Data approximate and based on an air line depth of 483 feet bls.
(b) Pumping water level measured at 378 feet bls. Static water level based on approximately 3 feet of drawdown measured in 1994.
(c) Data approximate and may be in error due to a plugged air line. Data not used for analysis.
(d) Water level anomalous. Data not used for analysis.
(e) Data approximate and based on an air line depth of 735 feet bls.
(f) Recovery water level 8 hours after pumping stopped.

msl = Mean sea level
bls = Below land surface
gpm = Gallons per minute
gpm/ft = Gallons per minute per foot
T29S/R39E = Township and Range, Mount Diablo Base Meridian
RMC = Rand Mining Company
NR = Not reported
(>) = Greater than
() = Data potentially out of date
RCWD = Rand Communities Water District
CPD = Consolidated Placer Dredging, Inc.



TABLE 3

ROUTINE CONSTITUENTS IN GROUNDWATER SAMPLES
NORTHERN FREMONT VALLEY WELLS

WELL IDENTIFIER	DATE	CONCENTRATIONS (mg/l)											EC (umhos)	pH
		Na ⁺	Ca ²⁺	Mg ²⁺	K ⁺	HCO ₃ ⁻	CO ₃ ²⁻	SO ₄ ²⁻	Cl ⁻	NO ₃ ²⁻	IDS			
T29S/R39E:														
12L02	10/17	154	99	52.0	0.0	285	0.0	468	21.0	0.8	1,010	NR	NR	
12L03	10/17	67	32	9.7	0.0	176	10.0	59	27.0	6.4	387	NR	NR	
12N01	09/55	143	74	60.0	7.3	302	0.0	432	25.0	7.6	992	1,330	7.4	
RMC-4	10/90	123	87	54.0	123.0	294	1.3	430	21.6	2.7	905	1,140	7.9	
	06/93	123	84	49.0	4.8	271	1.3	439	18.3	2.7	910	1,250	7.7	
15M01	06/53	182	79	117.0	11.0	216	4.0	782	50.0	3.7	1,400	1,840	8.4	
	08/61	108	85	94.0	8.5	251	0.0	576	30.0	0.0	1,200	1,490	7.9	
RCWD-1	08/93	82	34	11.4	5.8	212	2.6	74	38.0	27.4	440	650	7.8	
RCWD-2	12/92	86	38	14.6	5.2	210	1.3	91	49.3	13.7	490	700	8.1	
20QS01(a)	03/53	160	95	96.0	4.0	298	0.0	698	24.0	1.0	1,260	1,710	8.2	
29M01	04/53	141	50	37.0	9.0	227	0.0	138	187.0	5.0	714	1,130	7.7	
	04/60	121	37	28.0	8.2	211	0.0	171	82.0	3.0	611	920	7.9	
29N01	08/55	132	49	53.0	12.0	285	17.0	225	100.0	8.4	783	1,140	8.3	
	07/60	106	40	34.0	6.8	217	0.0	182	80.0	2.5	638	240	8.2	
33H01	08/55	160	47	36.0	0.8	146	0.0	74	305.0	6.9	1,030	1,440	7.9	
	07/60	156	41	27.0	8.6	141	3.0	64	261.0	0.9	712	1,200	8.3	
T29S/R40E:														
RMC-3	01/90	180	40	14.0	5.1	140	5.1	252	123.0	5.8	745	1,150	8.2	
	10/90	180	37	14.0	4.8	170	1.3	245	110.0	8.9	789	1,140	7.9	
22E02(b)	08/55	115	8	2.0	2.0	165	0.0	79	39.0	2.2	349	570	7.5	

NOTE: Refer to page 2 of this table for footnotes



HARGIS + ASSOCIATES, INC.

TABLE 3 (continued)
ROUTINE CONSTITUENTS
IN GROUNDWATER SAMPLES
NORTHERN FREMONT VALLEY WELLS
Page 2 of 2

WELL IDENTIFIER	DATE	CONCENTRATIONS (mg/l)										EC (umhos)	pH
		Na ⁺	Ca ²⁺	Mg ²⁺	K ⁺	HCO ₃ ⁻	CO ₃ ²⁻	SO ₄ ²⁻	Cl ⁻	NO ₃ ²⁻	TDS		
		T30S/R39E:											
3C01	04/62	197	90	47.0	8.2	144	0.0	97	460.0	1.8	1,090	1,880	8.0
8A01	05/53	463	145	36.0	13.0	151	0.0	303	778.0	5.0	510	3,080	7.6

FOOTNOTES

SOURCES: California Department of Water Resources, 1969
Rand Mining Company, 1990 through 1994
Rand Communities Water District, 1990 through 1993

- (a) Spring sample.
(b) Well designation on Table 1 as CDP-3.

mg/l = Milligrams per liter
TDS = Total dissolved solids
EC = Electrical conductivity
umhos = Micromhos
T29S/R39E = Township and Range, Mount Diablo Base Meridian
NR = Not reported
Na⁺ = Sodium, indicating ionic charge
Ca²⁺ = Calcium, indicating ionic charge
Mg²⁺ = Magnesium, indicating ionic charge
K⁺ = Potassium, indicating ionic charge
HCO₃⁻ = Bicarbonate, indicating ionic charge
CO₃²⁻ = Carbonate, indicating ionic charge
SO₄²⁻ = Sulfate, indicating ionic charge
Cl⁻ = Chlorine, indicating ionic charge
NO₃²⁻ = Nitrate, indicating ionic charge



TABLE 4
MAXIMUM CONTAMINANT LEVELS
FOR ORGANIC AND INORGANIC ANALYTES

<u>ORGANIC COMPOUNDS</u> <u>(micrograms per liter)</u>	<u>CALIFORNIA MCL</u>	<u>FEDERAL MCL</u>
<u>Volatile Organic Compounds</u>		
Tetrachloroethylene (PCE)	5	5
1,1,1-Trichloroethane (1,1,1-TCA)	200	200
<u>INORGANIC COMPOUNDS</u> <u>(milligrams per liter)</u>		
<u>CCR Trace Metals</u>		
Arsenic	0.05	0.05
Lead	0.05	0.05
Zinc	5(a)	5(a)
<u>Additional Trace Metals</u>		
Iron	0.3(a)	0.3(a)
Manganese	0.05(a)	0.05(a)
<u>Additional Inorganic Analytes</u>		
Total dissolved solids	500(a)	500(a)

SOURCES: California Department of Health Services, 1990
U.S. Environmental Protection Agency, 1993

(a) Secondary MCL

MCL = Maximum Contaminant Level

CCR = California Code of Regulations, Title 22



HARGIS + ASSOCIATES, INC.

TABLE 5

GROUNDWATER CONDITIONS AND AQUIFER HYDRAULIC PARAMETERS
NORTHERN FREMONT VALLEY

AREA	GROUNDWATER GRADIENT (ft/ft)	GROUNDWATER TYPE	ESTIMATED AQUIFER THICKNESS (feet)	TRANSMISSIVITY (gpd/ft)	HYDRAULIC CONDUCTIVITY (gpd/ft ²)	STORATIVITY
North of Garlock Fault	0.08	Magnesium-Sulfate or Sodium-Magnesium-Sulfate	>680	44,000	65	0.04
Northeast	0.03	Sodium-Sulfate or Sodium-Bicarbonate	>525	3,800	7.5	0.04
Central	0.004	Sodium-Bicarbonate	>475	30,000	150	0.04
Southwest	0.004	Sodium-Sulfate or Sodium-Chloride	>200	100,000	300	0.04

ft/ft = Foot per foot
 gpd/ft = Gallons per day per foot
 gpd/ft² = Gallons per day per square foot
 (>) = Greater than



TABLE 6

PROJECTED DRAWDOWNS

.....PRODUCTION WELL RMC-4 PUMPING ALONE.....										PRODUCTION WELL RMC-4 AND REGIONAL WELLS PUMPING.....					
LOCATION	MODEL CASE 1 (CURRENT)			MODEL CASE 2 (PROPOSED)			MODEL CASE 3 (CURRENT)			MODEL CASE 4 (PROPOSED)					
	6 YEARS	12 YEARS	16 YEARS	6 YEARS	12 YEARS	16 YEARS	6 YEARS	12 YEARS	16 YEARS	6 YEARS	12 YEARS	16 YEARS			
RMC-4	2.8	0.5	0.2	19.6	15.1	5.3	21.9	35.0	41.7	39.2	50.6	47.1			
RCWD Wells	1.3	0.5	0.3	4.7	5.8	4.1	23.7	38.1	44.4	27.1	43.6	48.4			
CPD Wells	0.1	0.1	0.1	0.1	0.3	0.7	-12.0	2.1	4.4	-12.0	2.4	4.9			
Agricultural Wells	0.8	0.4	0.2	1.9	3.3	2.9	34.6	46.7	51.8	35.8	49.7	54.6			
Koehn Lake	0.5	0.0	0.0	1.2	2.2	2.2	20.0	38.0	32.0	21.0	32.0	34.0			

NOTE: Approximate drawdown based on MODFLOW model simulations. Negative values indicate a water level rise due to recharge.

RMC = Rand Mining Company
 RCWD = Rand Communities Water District
 CPD = Consolidated Placer Dredging



HARGIS + ASSOCIATES, INC.

EXPLANATION

RAND COMMUNITIES WATER DISTRICT AND
ANTELOPE VALLEY - EAST KERN WATER AGENCY

DRAINAGE BASIN BOUNDARY

SOURCE

U.S.G.S. 1X2 DEGREE SERIES 1:250,000 SCALE MAPS
35118-A1 BAKERSFIELD, CALIFORNIA, 1962, REV. 1971; AND
35115-A1 TROMA, CALIFORNIA, 1957, REV. 1959.



RAND MINING COMPANY

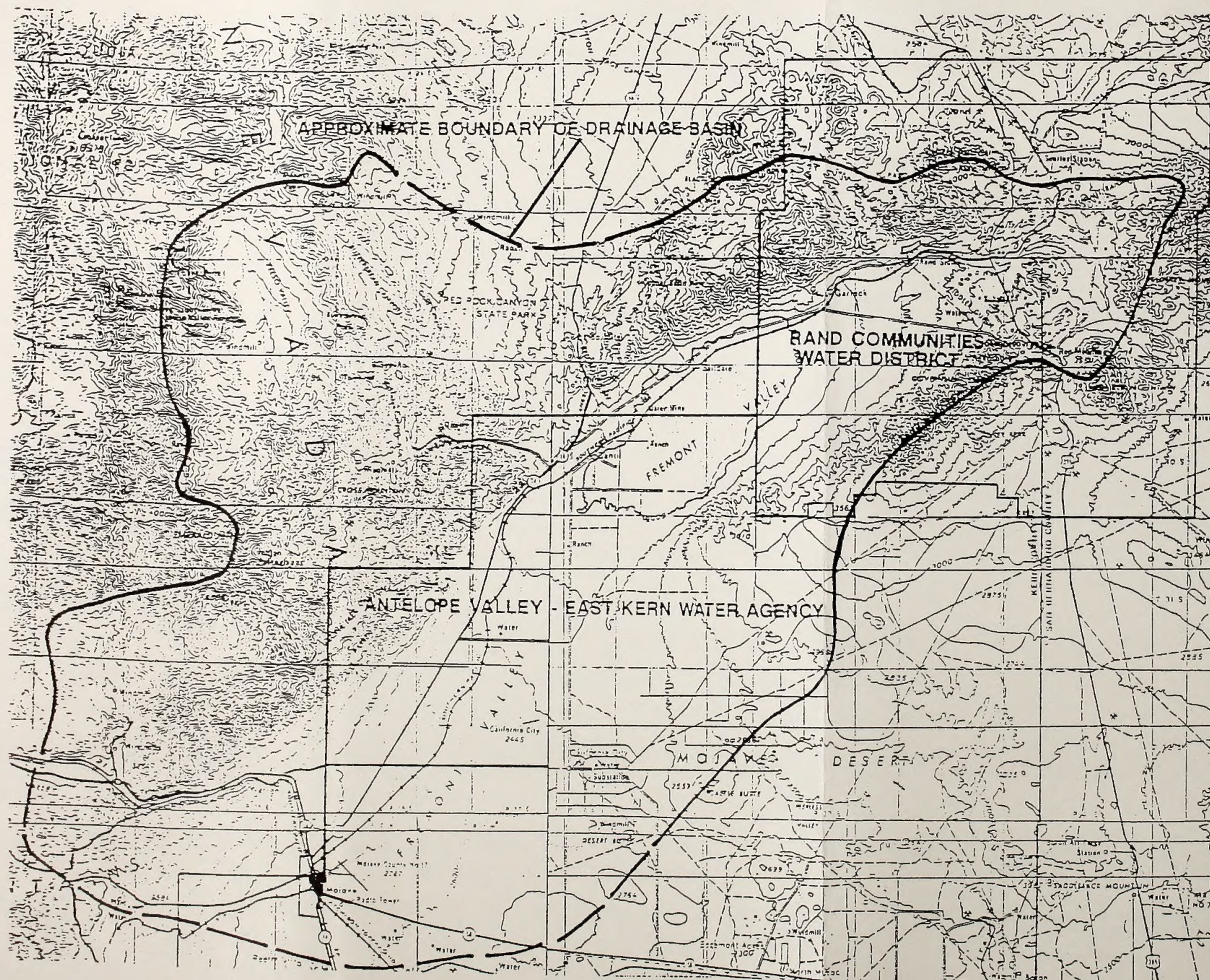
FREEMONT VALLEY BASIN

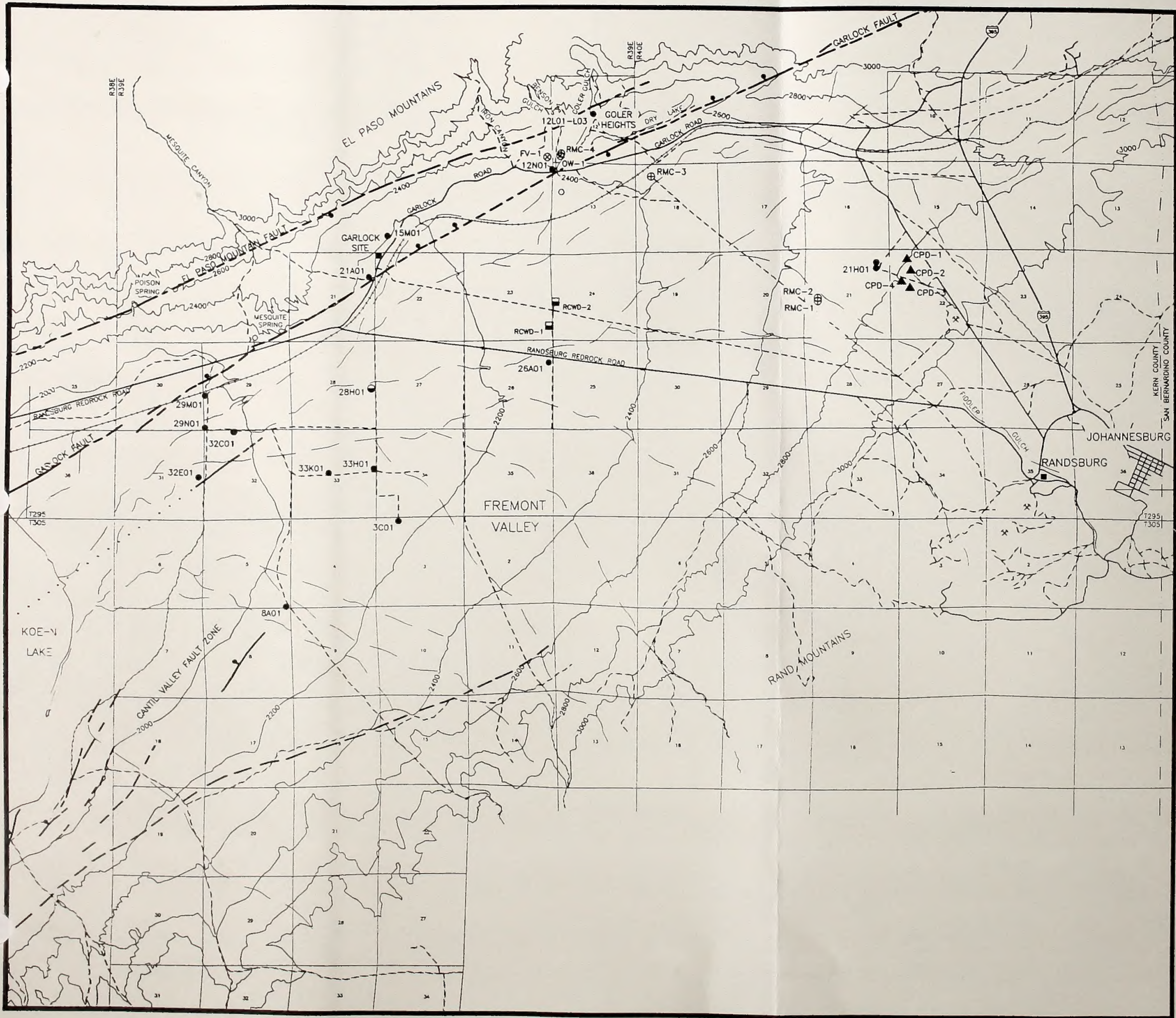
HARGIS + ASSOCIATES, INC.

6/94

FIGURE 1

PREP BY DGH REV BY mt RPT NO. 945 C/P A



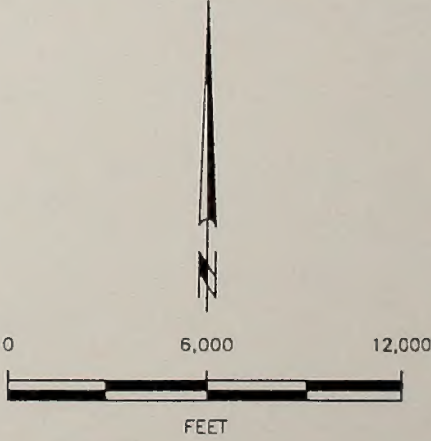


EXPLANATION

- RMC-4
⊕ RAND MINING COMPANY PRODUCTION WELL
- OW-1
⊗ RAND MINING COMPANY OBSERVATION WELL
- RCWD-2
⊠ RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2
▲ CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01
● AGRICULTURAL PRODUCTION WELL
- 2N01
● AGRICULTURAL OR INDUSTRIAL WELL
- /— FAULT, BAR AND BALL ON DOWNTHROWN SIDE.
DASHED WHERE UNCERTAIN, DOTTED WHERE INFERRED
- - - DIRT ROAD
- PAVED ROAD
- ✕ MINE
- SPRING

SOURCES:
BASE MAP PREPARED FROM GARLOCK, SALTDAL SE, EL PASO PEAKS, AND JOHANNESBURG 7 1/2 MINUTE QUADRANGLES. GEOLOGIC FAULTS BASED ON CLARK (1973), DMG (1976A-C), KOEHLER (1977), PAMPEYAM ET. AL (1988), AND JENNINGS (1975 AND 1992). WELL LOCATIONS BASED ON KOEHLER (1977), KREDGER & STEWART (1978), AND FIELD SITE RECONNAISSANCE CONDUCTED BY HARGIS + ASSOCIATES, INC. (1993 AND 1994)

CONTOUR INTERVAL = 200 FEET



RAND MINING COMPANY

WELL LOCATIONS

NORTHERN FREMONT VALLEY

 HARGIS + ASSOCIATES, INC. 6/94

FIGURE 2

PREP BY DAH REV BY JMT RPT NO. 945.03 120-0101 D

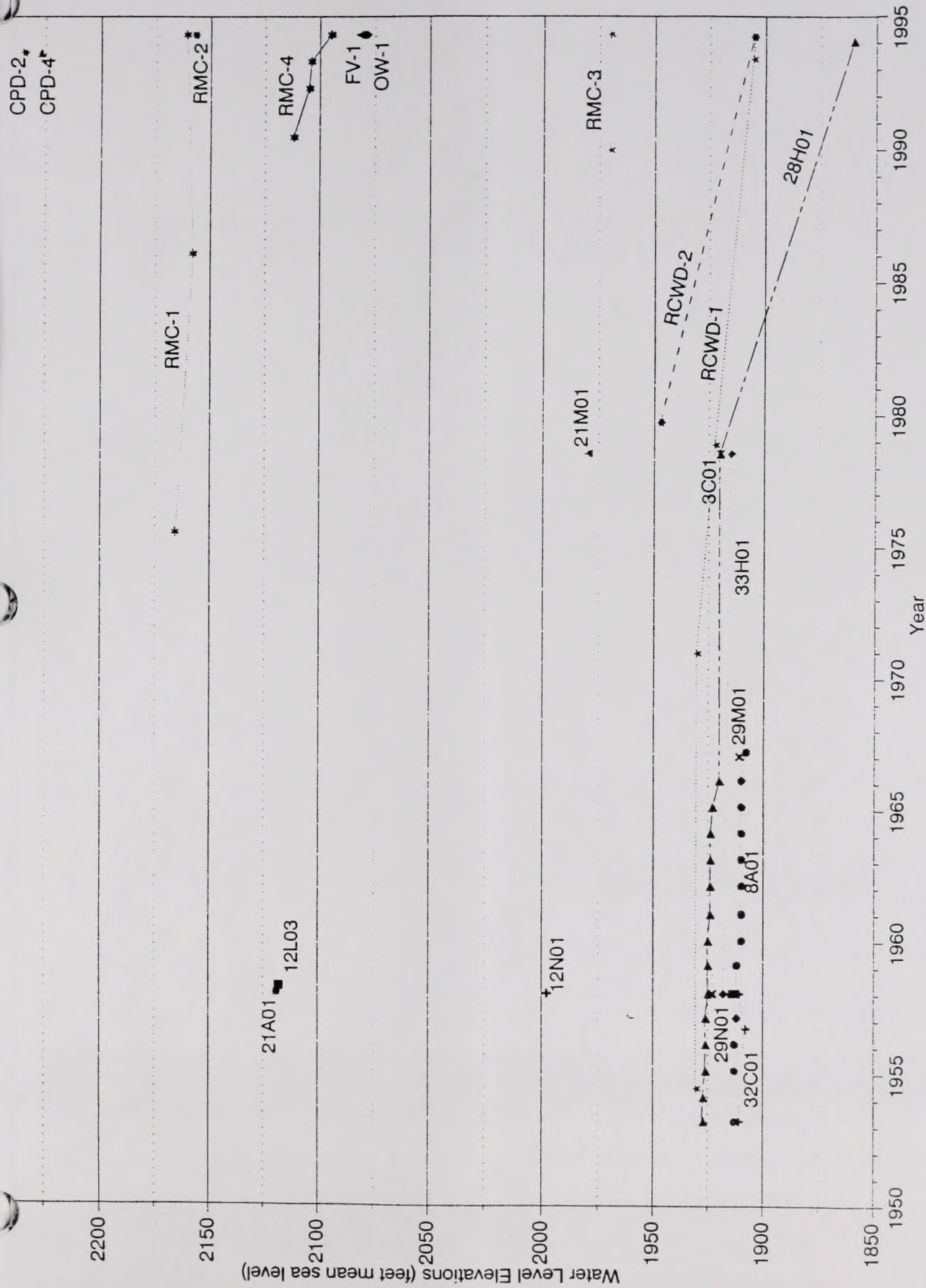


FIGURE 3. WATER LEVEL ELEVATIONS FOR REPRESENTATIVE NORTHERN FREMONT VALLEY WELLS



EXPLANATION

- RMC-4
⊕ RAND MINING COMPANY PRODUCTION WELL
- OW-1
⊗ RAND MINING COMPANY OBSERVATION WELL
- RCWD-2
⊕ RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2
▲ CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01
● AGRICULTURAL PRODUCTION WELL
- 12N01
● AGRICULTURAL OR INDUSTRIAL WELL
- OW-1
⊗ WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- 2082

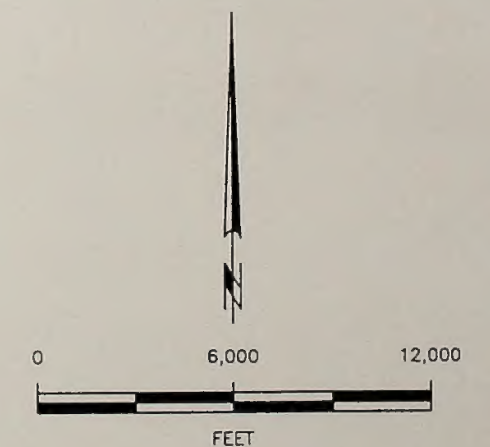
— 1960 — ?

CONTOUR LINE OF EQUAL ELEVATION
IN FEET MEAN SEA LEVEL. DASHED WHERE
APPROXIMATE, QUERIED WHERE INFERRED

CONTOUR INTERVAL = 40 FEET

NOTES:

WATER LEVELS MEASURED BY HARGIS + ASSOCIATES IN RMC, FV, AND CPD WELLS
ON MAY 2, 3, AND 12, 1994. WATER LEVELS MEASURED BY RCWD IN RCWD WELLS
ON APRIL 24, 1994. WATER LEVEL DATA FOR 28H01 OBTAINED FROM OWNER
AND MEASURED DURING SPRING 1994. STATIC WATER LEVELS MEASURED IN RMC-4,
RCWD-1, RCWD-2, AND CPD-1 MAY BE AFFECTED BY RECENT PUMPING.



RAND MINING COMPANY

**WATER LEVEL ELEVATIONS
MAY 1994
NORTHERN FREMONT VALLEY**



HARGIS + ASSOCIATES, INC.

6/94

FIGURE 4

PREP BY DAK REV BY INT RPT NO. 945.03 220-0388 C



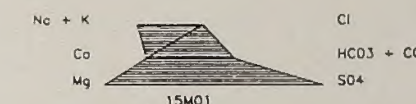
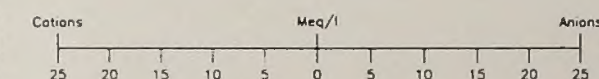


EXPLANATION

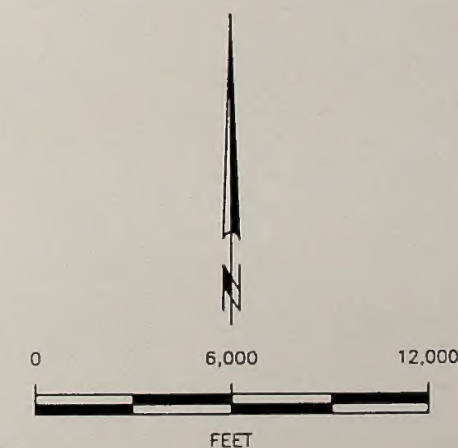
- RMC-4
⊕ RAND MINING COMPANY PRODUCTION WELL
- OW-1
⊗ RAND MINING COMPANY OBSERVATION WELL
- RCWD-2
⊕ RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2
▲ CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01
● AGRICULTURAL PRODUCTION WELL
- 12N01
● AGRICULTURAL OR INDUSTRIAL WELL
- 15M01
● CONCENTRATION OF TOTAL DISSOLVED SOLIDS IN MILLIGRAMS PER LITER

500

CONTOUR LINE OF EQUAL CONCENTRATIONS OF TOTAL DISSOLVED SOLIDS DETECTED IN GROUNDWATER SAMPLES. DASHED WHERE APPROXIMATE, QUERIED WHERE INFERRED



NOTES:
GROUNDWATER SAMPLES COLLECTED FROM RMC-3, RMC-4, RCWD-1, AND RCWD-2 DURING THE PERIOD 1990 TO 1993. ALL OTHER GROUNDWATER SAMPLES COLLECTED DURING THE PERIOD 1917 THROUGH 1962. STIFF DIAGRAMS SHOWN FOR WATER QUALITY SAMPLE COLLECTED MOST RECENTLY. WATER QUALITY DATA FROM WELL 12L03 ARE CONSIDERED ANOMALOUS AND WERE NOT USED FOR CONTOURING.



RAND MINING COMPANY

INORGANIC GROUNDWATER QUALITY
NORTHERN FREMONT VALLEY

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FIGURE 5

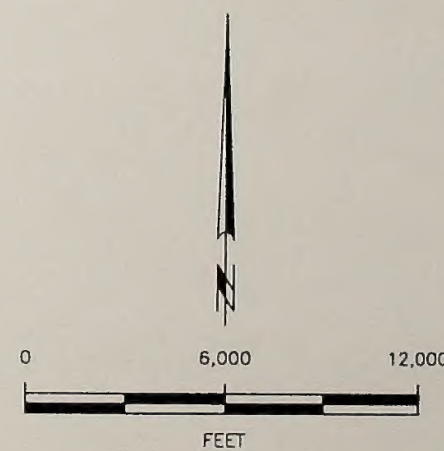
PREP BY DAK REV BY JMT RPT NO. 945.03 210-0483 B

EXPLANATION

- RMC-4
⊕ RAND MINING COMPANY PRODUCTION WELL
- OW-1
⊗ RAND MINING COMPANY OBSERVATION WELL
- RCWD-2
□ RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2
▲ CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01
● AGRICULTURAL PRODUCTION WELL
- 12N01
● AGRICULTURAL OR INDUSTRIAL WELL

TYPE = $Mg-SO_4$
 GRADIENT = 0.004
 T = 44,000 GPD/FT
 b = >680 FEET
 K = 65 GPD/FT²
 S = 0.04

--- APPROXIMATE BOUNDARY BETWEEN AREAS OF EQUIVALENT
 GROUNDWATER CONDITIONS AND HYDRAULIC PARAMETERS



RAND MINING COMPANY

GROUNDWATER CONDITIONS AND AQUIFER HYDRAULIC PARAMETERS NORTHERN FREMONT VALLEY

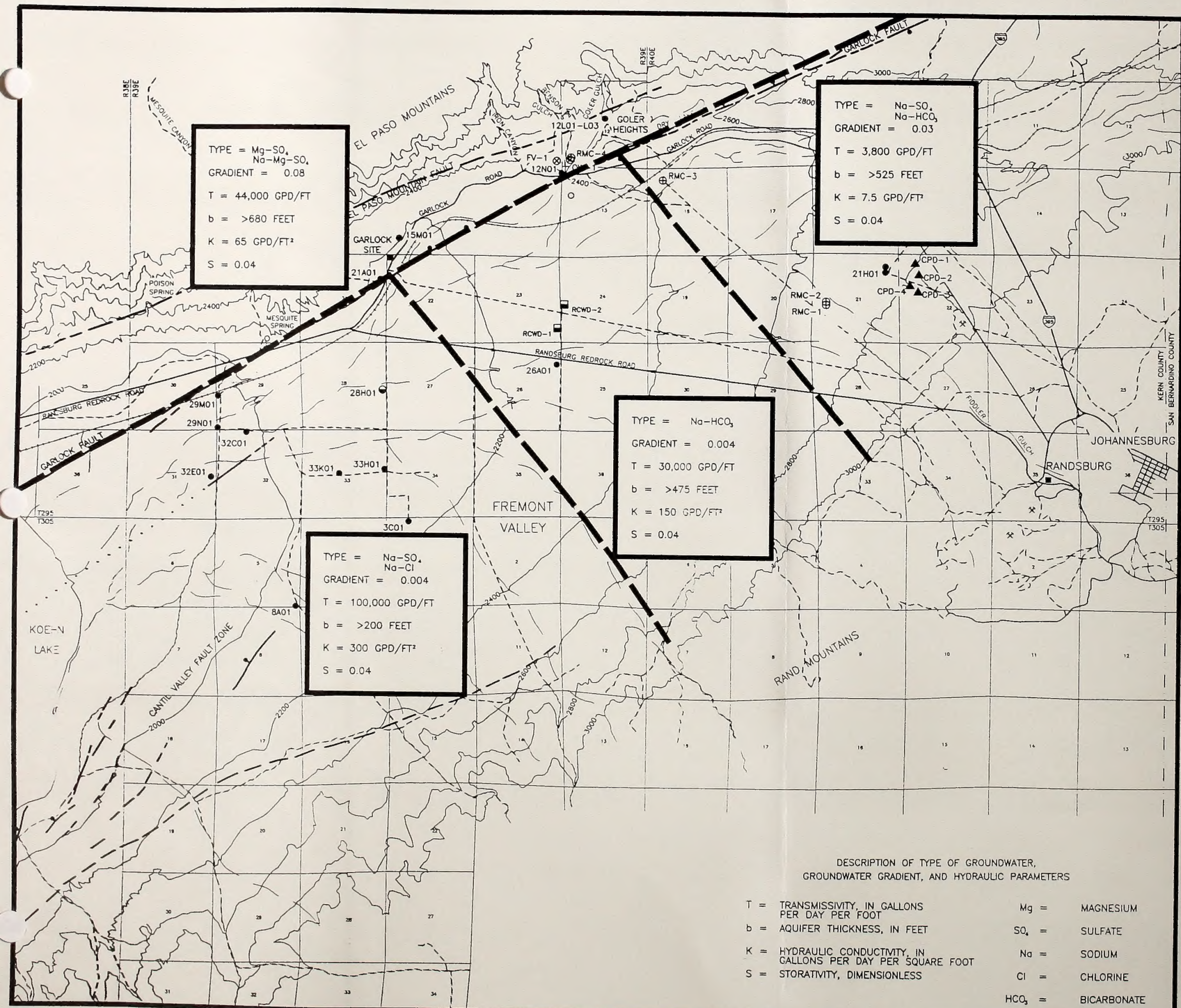


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FIGURE 6

PREP BY DAH REV BY TMT RPT NO. 945.03 215-0024 A



TYPE = $Mg-SO_4$
 $Na-Mg-SO_4$
 GRADIENT = 0.08
 T = 44,000 GPD/FT
 b = >680 FEET
 K = 65 GPD/FT²
 S = 0.04

TYPE = $Na-SO_4$
 $Na-HCO_3$
 GRADIENT = 0.03
 T = 3,800 GPD/FT
 b = >525 FEET
 K = 7.5 GPD/FT²
 S = 0.04

TYPE = $Na-HCO_3$
 GRADIENT = 0.004
 T = 30,000 GPD/FT
 b = >475 FEET
 K = 150 GPD/FT²
 S = 0.04

TYPE = $Na-SO_4$
 $Na-Cl$
 GRADIENT = 0.004
 T = 100,000 GPD/FT
 b = >200 FEET
 K = 300 GPD/FT²
 S = 0.04

DESCRIPTION OF TYPE OF GROUNDWATER, GROUNDWATER GRADIENT, AND HYDRAULIC PARAMETERS

- | | |
|--|-----------------------|
| T = TRANSMISSIVITY, IN GALLONS PER DAY PER FOOT | Mg = MAGNESIUM |
| b = AQUIFER THICKNESS, IN FEET | SO_4 = SULFATE |
| K = HYDRAULIC CONDUCTIVITY, IN GALLONS PER DAY PER SQUARE FOOT | Na = SODIUM |
| S = STORATIVITY, DIMENSIONLESS | Cl = CHLORINE |
| | HCO_3 = BICARBONATE |

EXPLANATION

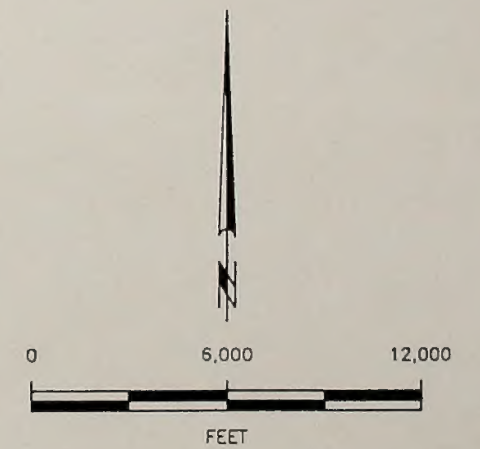
- RMC-4
⊕ RAND MINING COMPANY PRODUCTION WELL
- OW-1
⊗ RAND MINING COMPANY OBSERVATION WELL
- RCWD-2
⊞ RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2
▲ CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01
● AGRICULTURAL PRODUCTION WELL
- 12N01
● AGRICULTURAL OR INDUSTRIAL WELL

— 2.0 —
CONTOUR LINE OF EQUAL PROJECTED DRAWDOWN

CONTOUR INTERVAL = 0.5 FEET

NOTES:

PROJECTED DRAWDOWN BASED ON MODFLOW MODEL RESULTS FOR MODEL CASE 1, BASED ON PRODUCTION WELL RMC-4 PUMPING ALONE. PROPOSED INCREASED PUMPAGE DUE TO RAND PROJECT IS NOT INCLUDED.



RAND MINING COMPANY

**PROJECTED EXTENT OF DRAWDOWN
AFTER 6 YEARS, MODEL CASE 1**

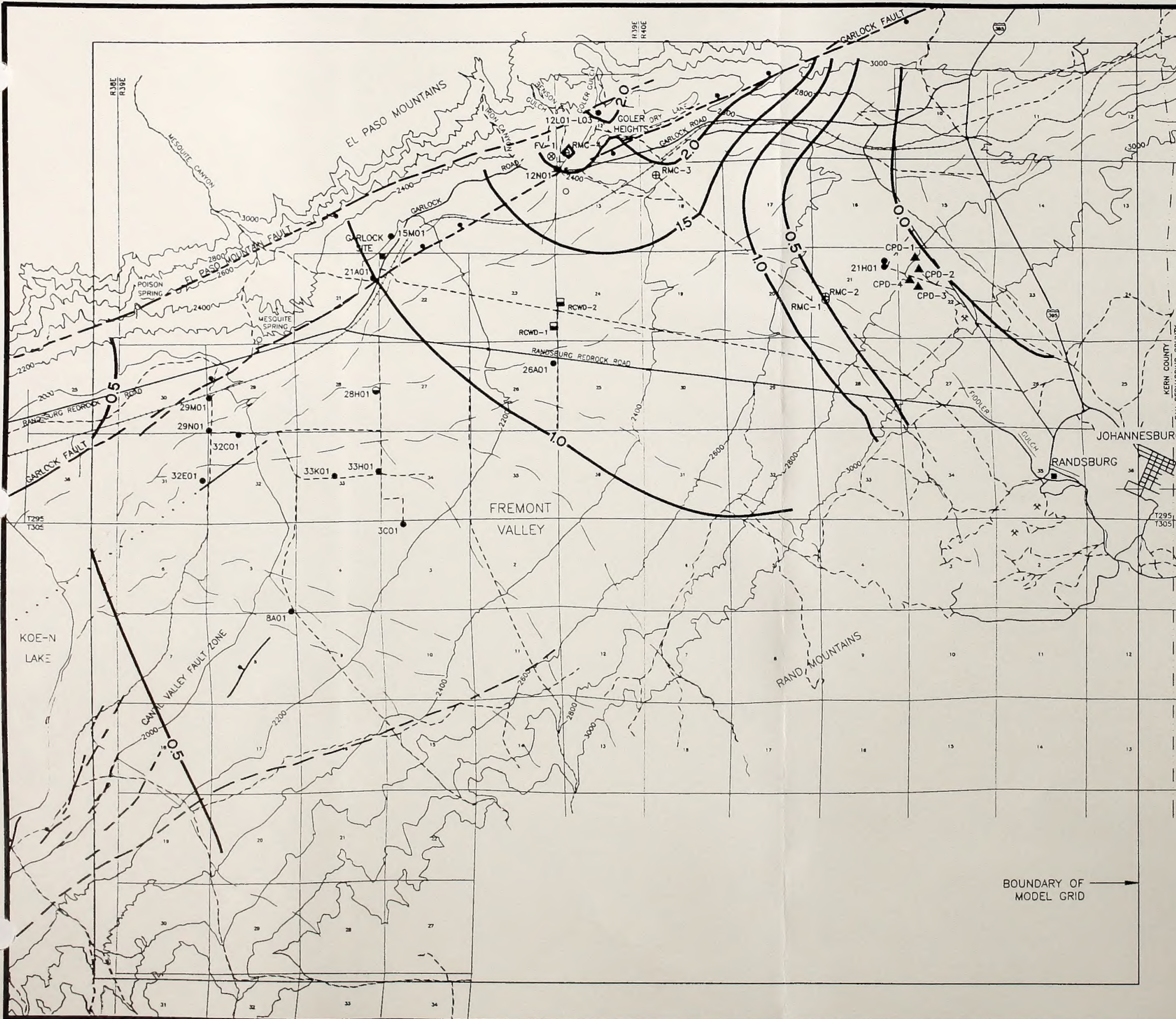


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FIGURE 7

PREP BY DAH REV BY JMT RPT NO. 945.03 220-0389 A



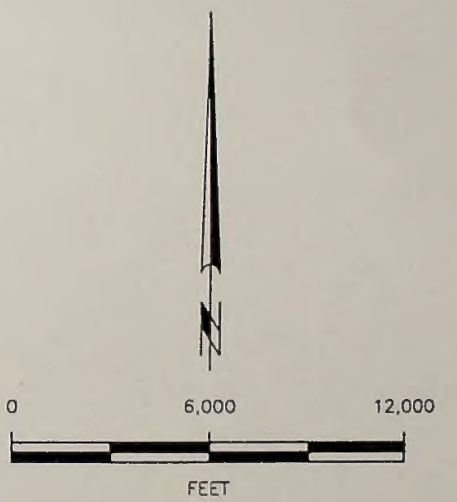
EXPLANATION

- RMC-4 RAND MINING COMPANY PRODUCTION WELL
- OW-1 RAND MINING COMPANY OBSERVATION WELL
- RCWD-2 RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2 CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01 AGRICULTURAL PRODUCTION WELL
- 12N01 AGRICULTURAL OR INDUSTRIAL WELL

0.5
CONTOUR LINE OF EQUAL PROJECTED DRAWDOWN

CONTOUR INTERVAL = 0.5 FEET

NOTES:
PROJECTED DRAWDOWN BASED ON MODFLOW MODEL RESULTS FOR MODEL CASE 1 BASED ON PRODUCTION WELL RMC-4 PUMPING ALONE. PROPOSED INCREASED PUMPAGE DUE TO RAND PROJECT IS NOT INCLUDED.



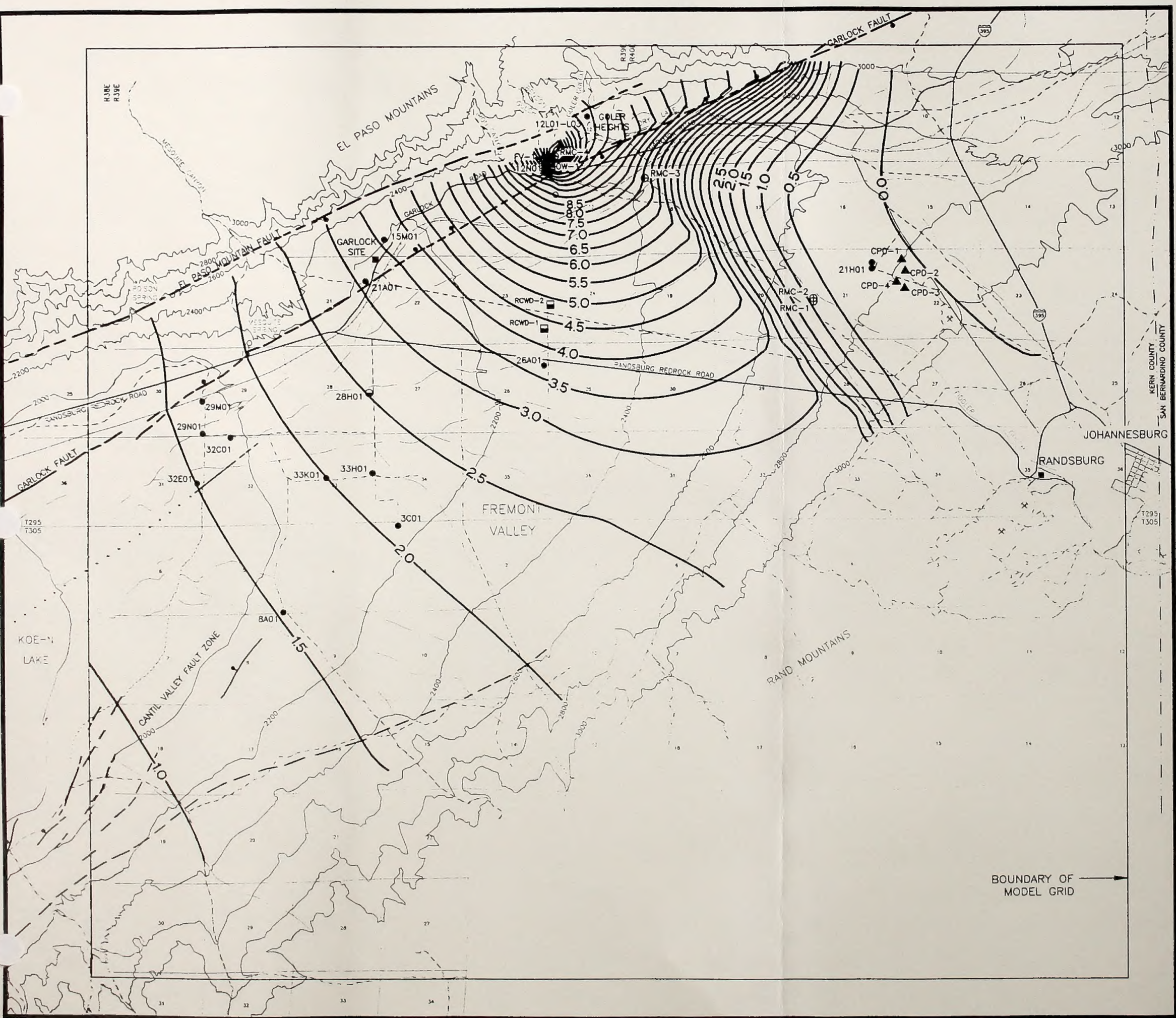
RAND MINING COMPANY

PROJECTED EXTENT OF DRAWDOWN
AFTER 16 YEARS, MODEL CASE 1

 HARGIS + ASSOCIATES, INC. 6/94

FIGURE 8

PREP BY DAH REV BY TMT RPT NO. 945.03 220-0396 A



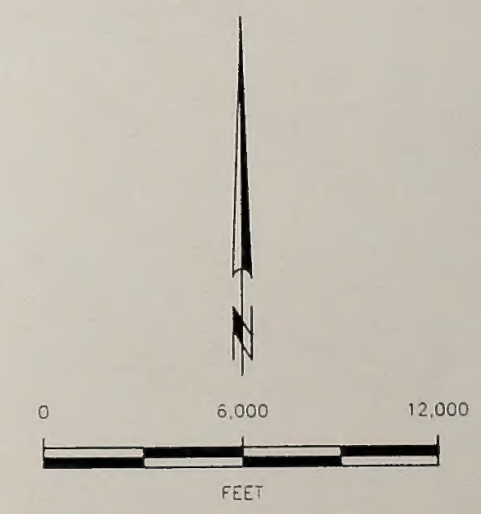
EXPLANATION

- RMC-4
⊕
RAND MINING COMPANY PRODUCTION WELL
- OW-1
⊙
RAND MINING COMPANY OBSERVATION WELL
- RCWD-2
⊠
RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPI-2
▲
CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01
●
AGRICULTURAL PRODUCTION WELL
- 12H01
●
AGRICULTURAL OR INDUSTRIAL WELL

— 2.0 —
CONTOUR LINE OF EQUAL PROJECTED DRAWDOWN

CONTOUR INTERVAL = 0.5 FEET

NOTES:
PROJECTED DRAWDOWN BASED ON MODFLOW MODEL RESULTS FOR
MODEL CASE 2 BASED ON PRODUCTION WELL RMC-4 PUMPING ALONE.
PROPOSED INCREASED PUMPAGE DUE TO RAND PROJECT IS INCLUDED.



RAND MINING COMPANY

PROJECTED EXTENT OF DRAWDOWN
AFTER 6 YEARS, MODEL CASE 2

HARGIS + ASSOCIATES, INC.

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FIGURE 9

PREP BY DAH REV BY TMT RPT NO 945.03 220-0397 8

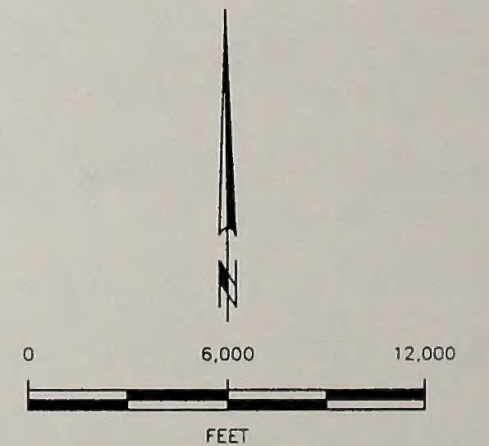
EXPLANATION

- RMC-4 RAND MINING COMPANY PRODUCTION WELL
- OW-1 RAND MINING COMPANY OBSERVATION WELL
- RCWD-2 RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2 CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01 AGRICULTURAL PRODUCTION WELL
- 12N01 AGRICULTURAL OR INDUSTRIAL WELL

2.0
CONTOUR LINE OF EQUAL PROJECTED DRAWDOWN

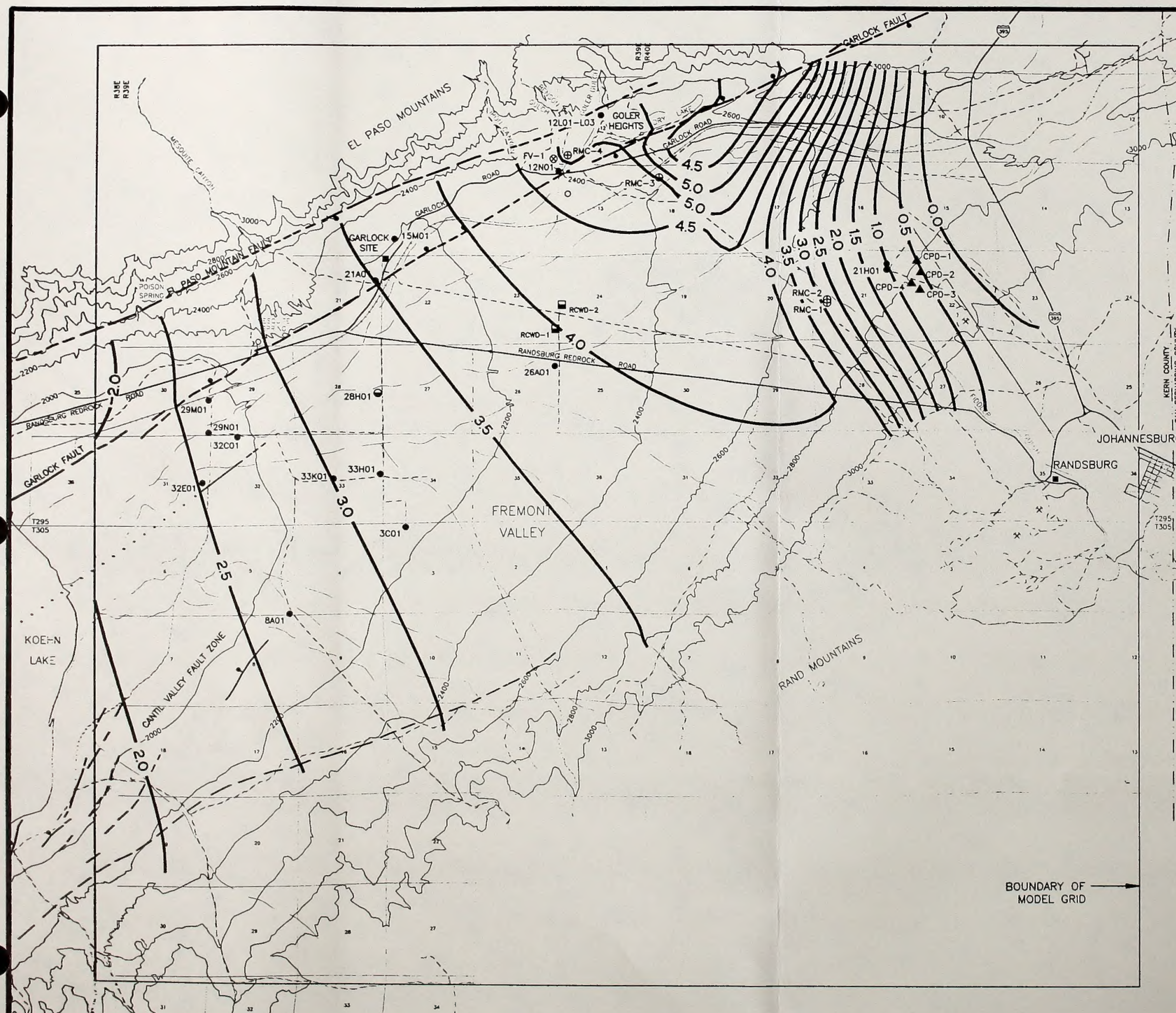
CONTOUR INTERVAL = 0.5 FOOT

NOTES:
PROJECTED DRAWDOWN BASED ON MODFLOW MODEL RESULTS FOR MODEL CASE 2 BASED ON PRODUCTION WELL RMC-4 PUMPING ALONE. PROPOSED INCREASED PUMPAGE DUE TO RAND PROJECT IS INCLUDED.



RAND MINING COMPANY

**PROJECTED EXTENT OF DRAWDOWN
AFTER 16 YEARS, MODEL CASE 2**



EXPLANATION

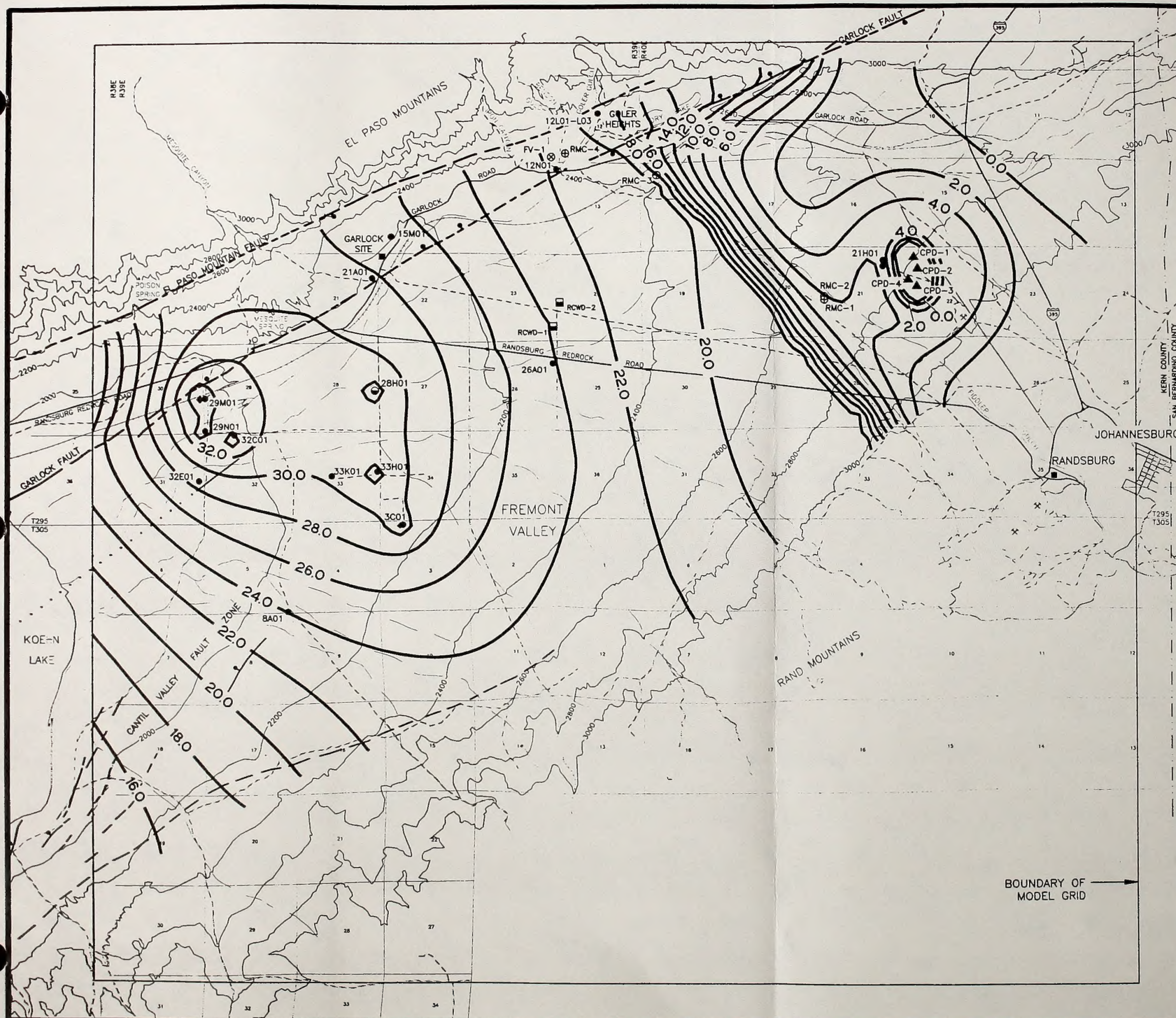
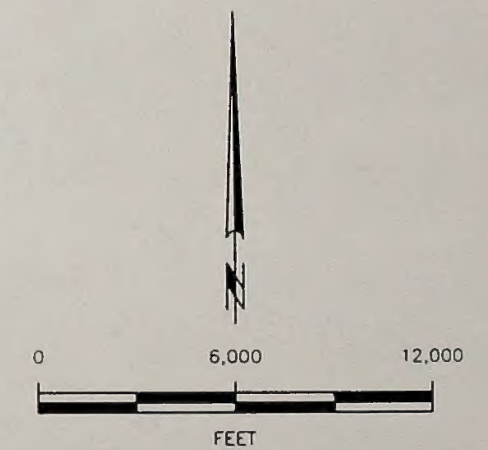
- RMC-4
⊗ RAND MINING COMPANY PRODUCTION WELL
- OW-1
⊗ RAND MINING COMPANY OBSERVATION WELL
- RCWD-2
⊗ RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2
▲ CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01
● AGRICULTURAL PRODUCTION WELL
- 12N01
● AGRICULTURAL OR INDUSTRIAL WELL

20.0

CONTOUR LINE OF EQUAL PROJECTED DRAWDOWN

CONTOUR INTERVAL = 2 FEET

NOTES:
PROJECTED DRAWDOWN BASED ON MODFLOW MODEL RESULTS FOR MODEL CASE 3 BASED ON PRODUCTION WELL RMC-4 AND REGIONAL WELLS PUMPING. PROPOSED INCREASED PUMPAGE DUE TO RAND PROJECT IS NOT INCLUDED.



RAND MINING COMPANY

PROJECTED EXTENT OF DRAWDOWN
AFTER 6 YEARS, MODEL CASE 3

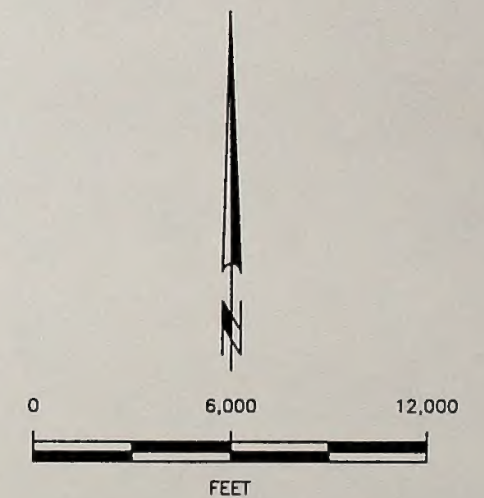
EXPLANATION

- RMC-4 RAND MINING COMPANY PRODUCTION WELL
- OW-1 RAND MINING COMPANY OBSERVATION WELL
- RCWD-2 RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2 CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01 AGRICULTURAL PRODUCTION WELL
- 12N01 AGRICULTURAL OR INDUSTRIAL WELL

50.0
CONTOUR LINE OF EQUAL PROJECTED DRAWDOWN

CONTOUR INTERVAL = 4 FEET

NOTES:
PROJECTED DRAWDOWN BASED ON MODFLOW MODEL RESULTS FOR MODEL CASE 3 BASED ON PRODUCTION WELL RMC-4 AND REGIONAL WELLS PUMPING. PROPOSED INCREASED PUMPAGE DUE TO RAND PROJECT IS NOT INCLUDED.



RAND MINING COMPANY

**PROJECTED EXTENT OF DRAWDOWN
AFTER 16 YEARS, MODEL CASE 3**

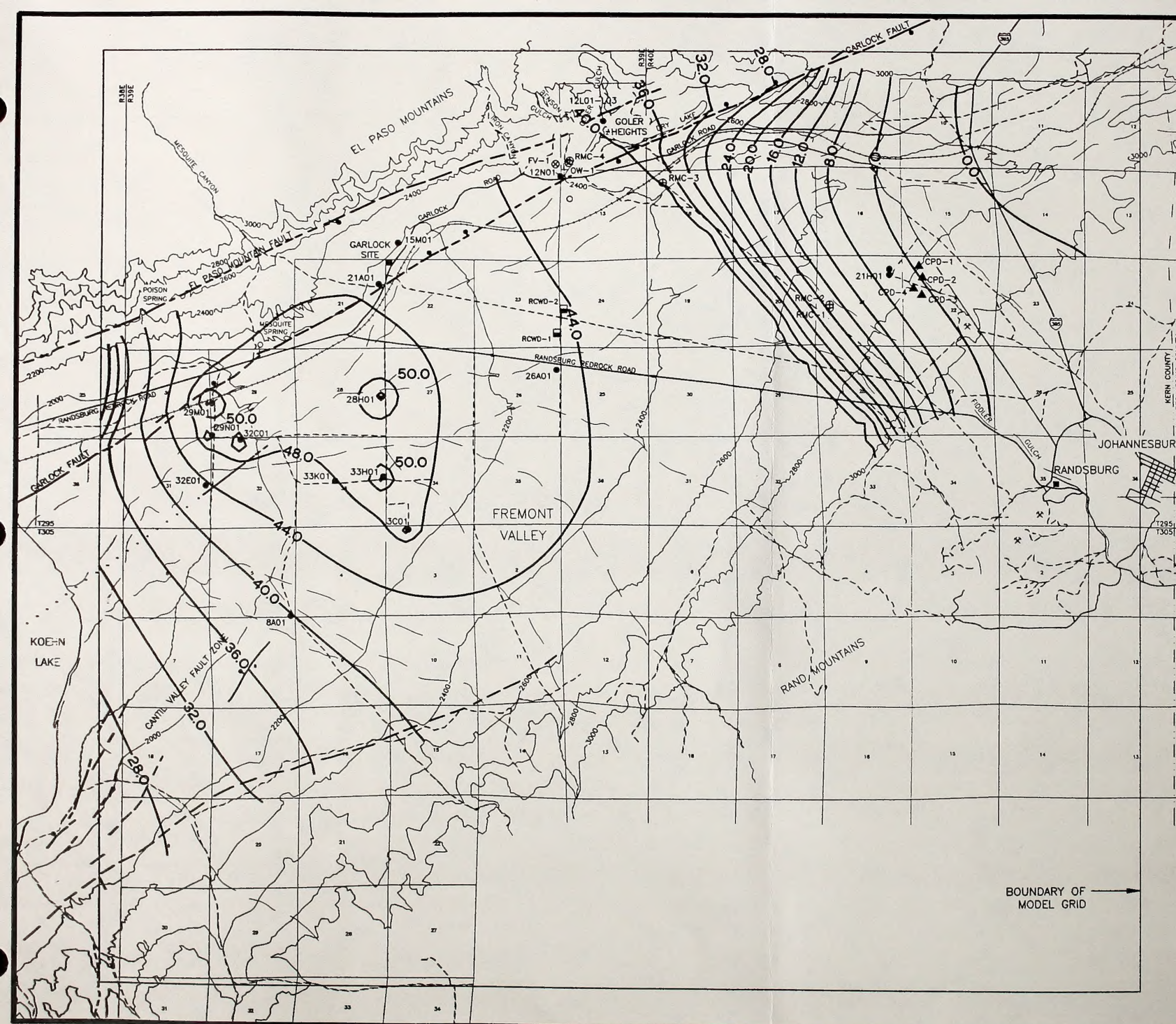


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FIGURE 12

PREP BY *DAH* REV BY *TMT* RPT NO. 945.03 220-0398 A



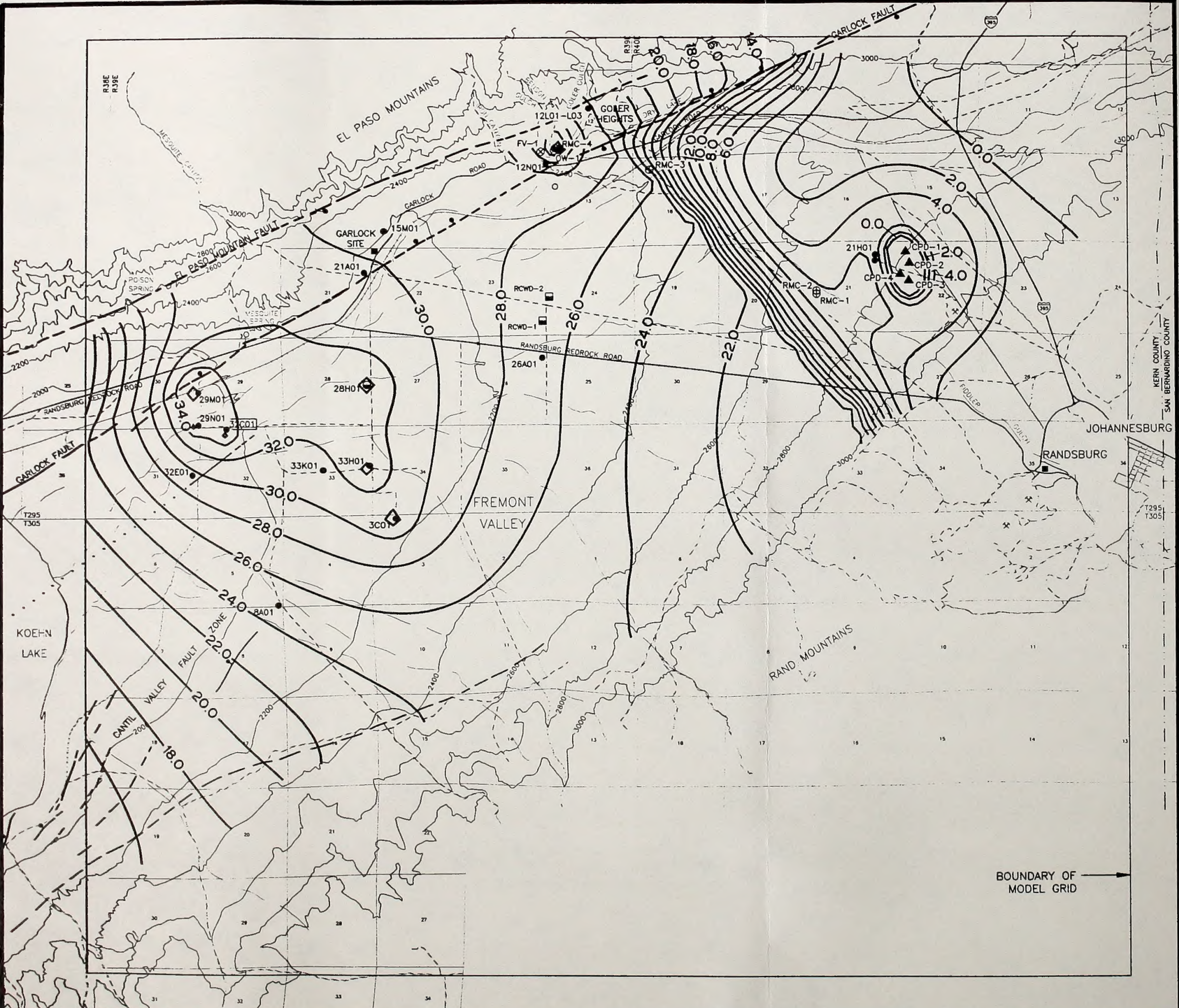
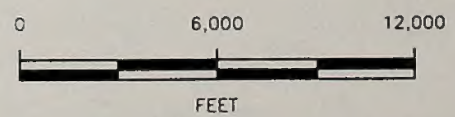
EXPLANATION

- RMC-4 RAND MINING COMPANY PRODUCTION WELL
- OW-1 RAND MINING COMPANY OBSERVATION WELL
- RCWD-2 RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2 CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01 AGRICULTURAL PRODUCTION WELL
- 12N01 AGRICULTURAL OR INDUSTRIAL WELL

20.0
CONTOUR LINE OF EQUAL PROJECTED DRAWDOWN

CONTOUR INTERVAL = 2 FEET

NOTES:
PROJECTED DRAWDOWN BASED ON MODFLOW MODEL RESULTS FOR MODEL CASE 4 BASED ON PRODUCTION WELL RMC-4 AND REGIONAL WELLS PUMPING. PROPOSED INCREASED PUMPAGE DUE TO RAND PROJECT IS INCLUDED.



RAND MINING COMPANY

PROJECTED EXTENT OF DRAWDOWN
AFTER 6 YEARS, MODEL CASE 4

HARGIS+ASSOCIATES, INC.

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FIGURE 13

PREP BY DAH REV BY TMT RPT NO. 945.03 220-0399 B

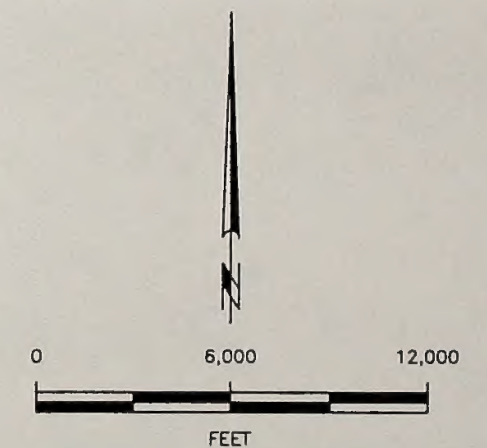
EXPLANATION

- RMC-4
⊕ RAND MINING COMPANY PRODUCTION WELL
- OW-1
⊗ RAND MINING COMPANY OBSERVATION WELL
- RCWD-2
⊞ RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2
▲ CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01
● AGRICULTURAL PRODUCTION WELL
- 12N01
● AGRICULTURAL OR INDUSTRIAL WELL

50.0
CONTOUR LINE OF EQUAL PROJECTED DRAWDOWN

CONTOUR INTERVAL = 4 FEET

NOTES:
PROJECTED DRAWDOWN BASED ON MODFLOW MODEL RESULTS FOR MODEL CASE 4 BASED ON PRODUCTION WELL RMC-4 AND REGIONAL WELLS PUMPING. PROPOSED INCREASED PUMPAGE DUE TO RAND PROJECT IS INCLUDED.



RAND MINING COMPANY

PROJECTED EXTENT OF DRAWDOWN
AFTER 16 YEARS, MODEL CASE 4

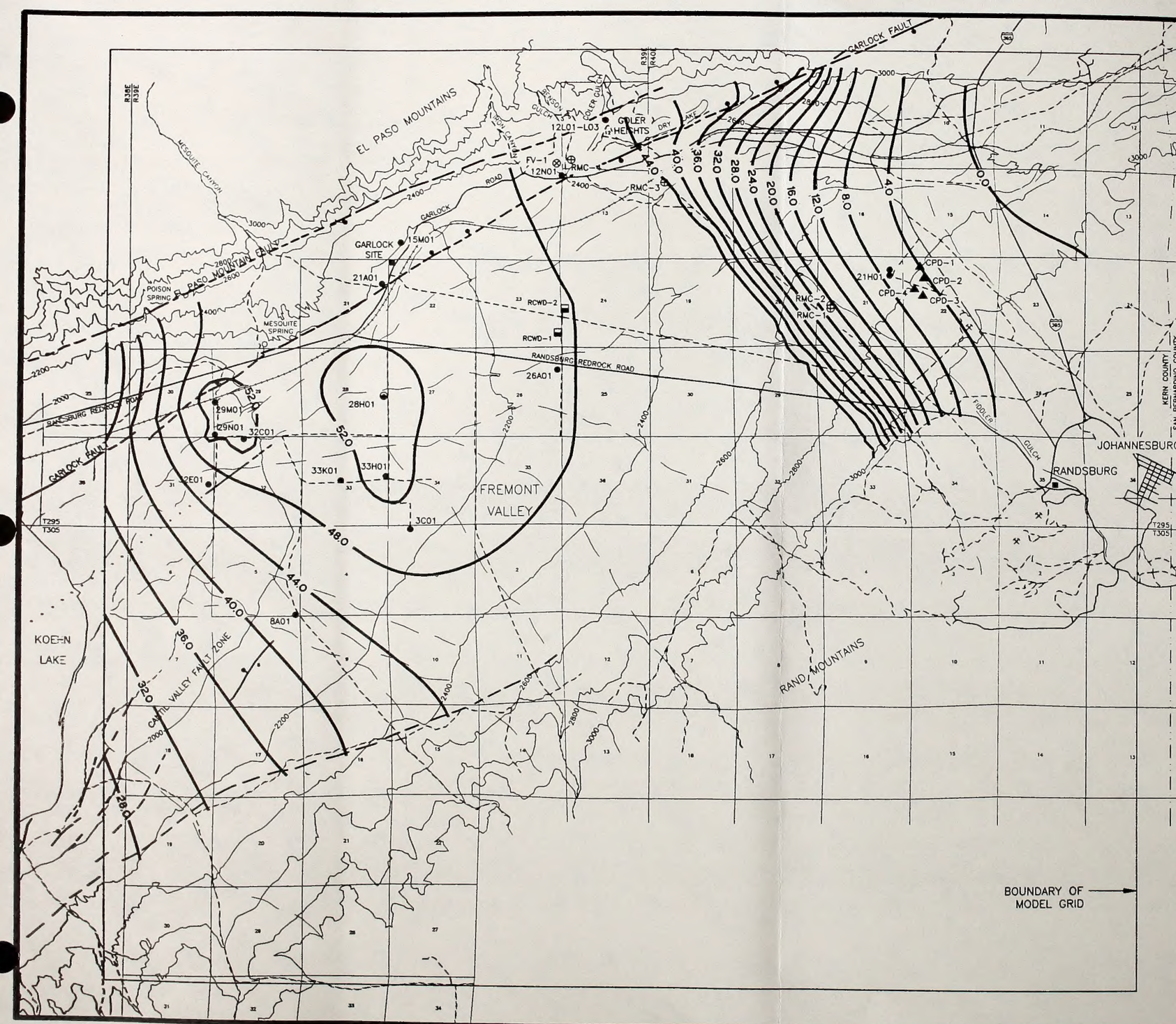


HARGIS + ASSOCIATES, INC.

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FIGURE 14

PREP BY DAH REV BY TMT RPT NO. 945.03 220-0392 A



EXPLANATION

- RMC-4
⊕ RAND MINING COMPANY PRODUCTION WELL
- OW-1
⊕ RAND MINING COMPANY OBSERVATION WELL
- RCWD-2
⊕ RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2
▲ CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01
● AGRICULTURAL PRODUCTION WELL
- 12N01
● AGRICULTURAL OR INDUSTRIAL WELL
- RCWD-2
1858
□ WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL

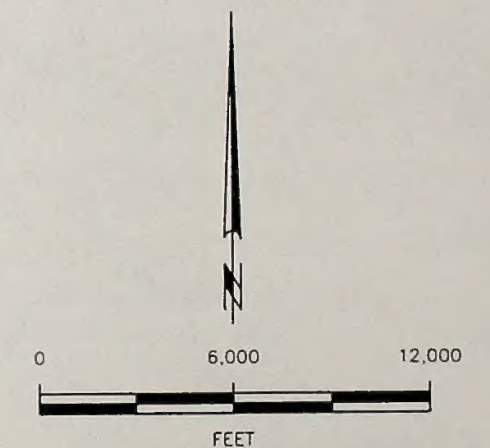
— 1970 — — ?

CONTOUR LINE OF EQUAL ELEVATION
IN FEET MEAN SEA LEVEL. DASHED WHERE
APPROXIMATE, QUERIED WHERE INFERRED

CONTOUR INTERVAL = 40 FEET

NOTES:

PROJECTED WATER ELEVATIONS GENERATED USING MODFLOW
MODEL RESULTS FOR MODEL CASE 3, BASED ON PRODUCTION
WELL RMC-4 AND REGIONAL WELLS PUMPING. PROPOSED
INCREASED PUMPAGE DUE TO RAND PROJECT IS NOT INCLUDED.



RAND MINING COMPANY

PROJECTED WATER LEVEL ELEVATIONS
AFTER 16 YEARS, MODEL CASE 3

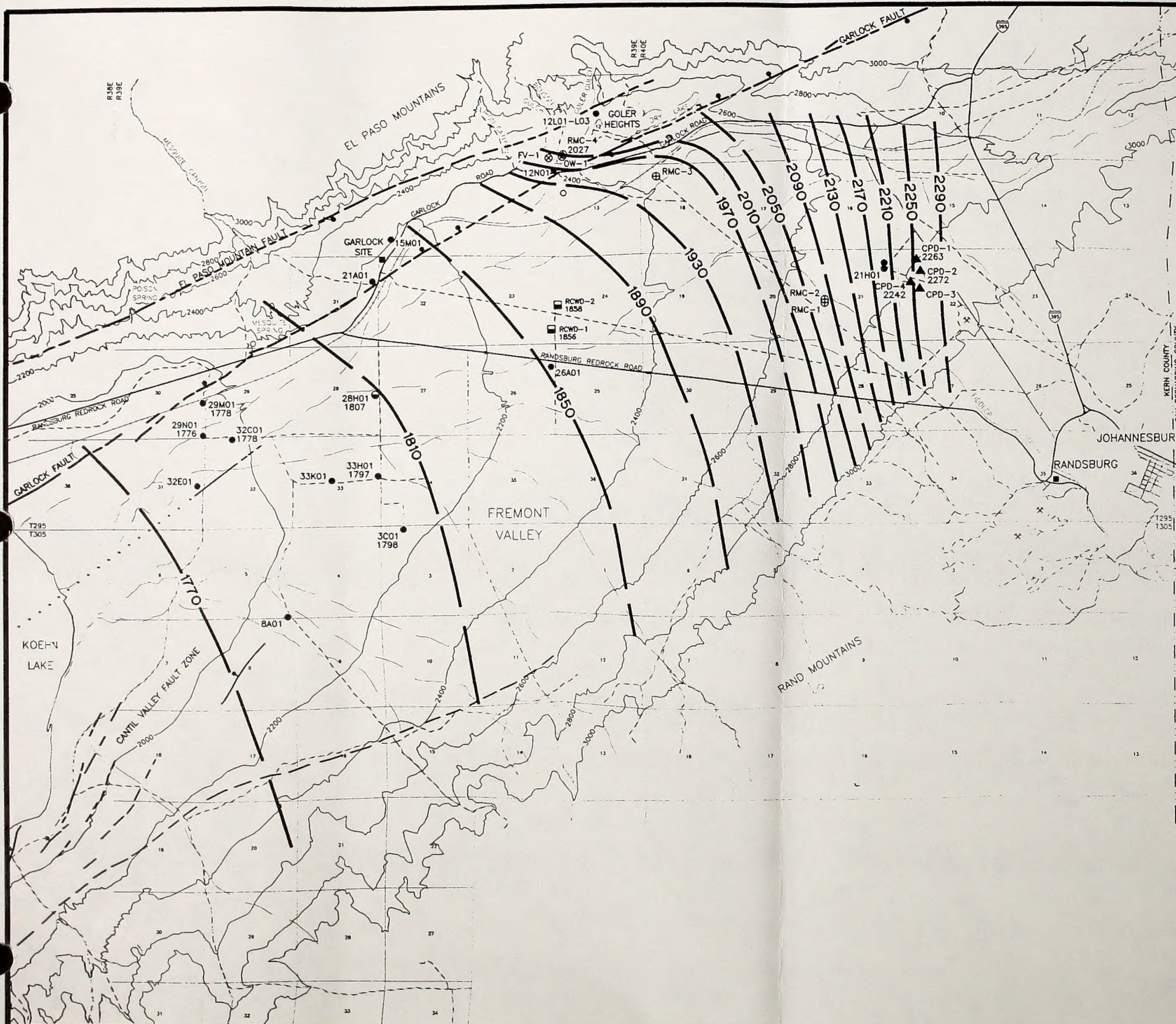


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FIGURE 15

PREP BY DAM REV BY TMT RPT NO 945.03 220-0393 A



EXPLANATION

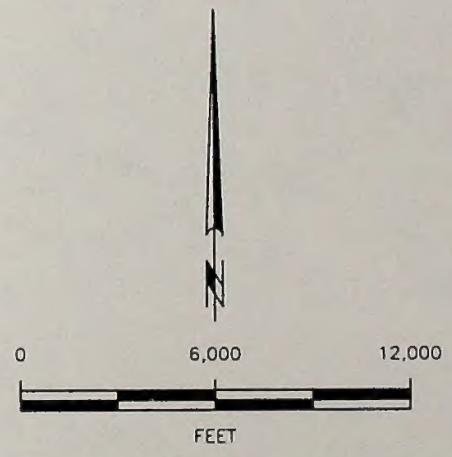
- RMC-4 RAND MINING COMPANY PRODUCTION WELL
- OW-1 RAND MINING COMPANY OBSERVATION WELL
- RCWD-2 RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2 CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01 AGRICULTURAL PRODUCTION WELL
- 12N01 AGRICULTURAL OR INDUSTRIAL WELL
- RCWD-2 WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- 1854

1970 ?

CONTOUR LINE OF EQUAL ELEVATION
IN FEET MEAN SEA LEVEL. DASHED WHERE
APPROXIMATE, QUERIED WHERE INFERRED

CONTOUR INTERVAL = 40 FEET

NOTES:
PROJECTED WATER ELEVATIONS GENERATED USING
MODFLOW MODEL RESULTS FOR MODEL CASE 4,
BASED ON PRODUCTION WELL RMC-4 AND REGIONAL
WELLS PUMPING. PROPOSED INCREASED PUMPAGE
DUE TO RAND PROJECT IS INCLUDED.



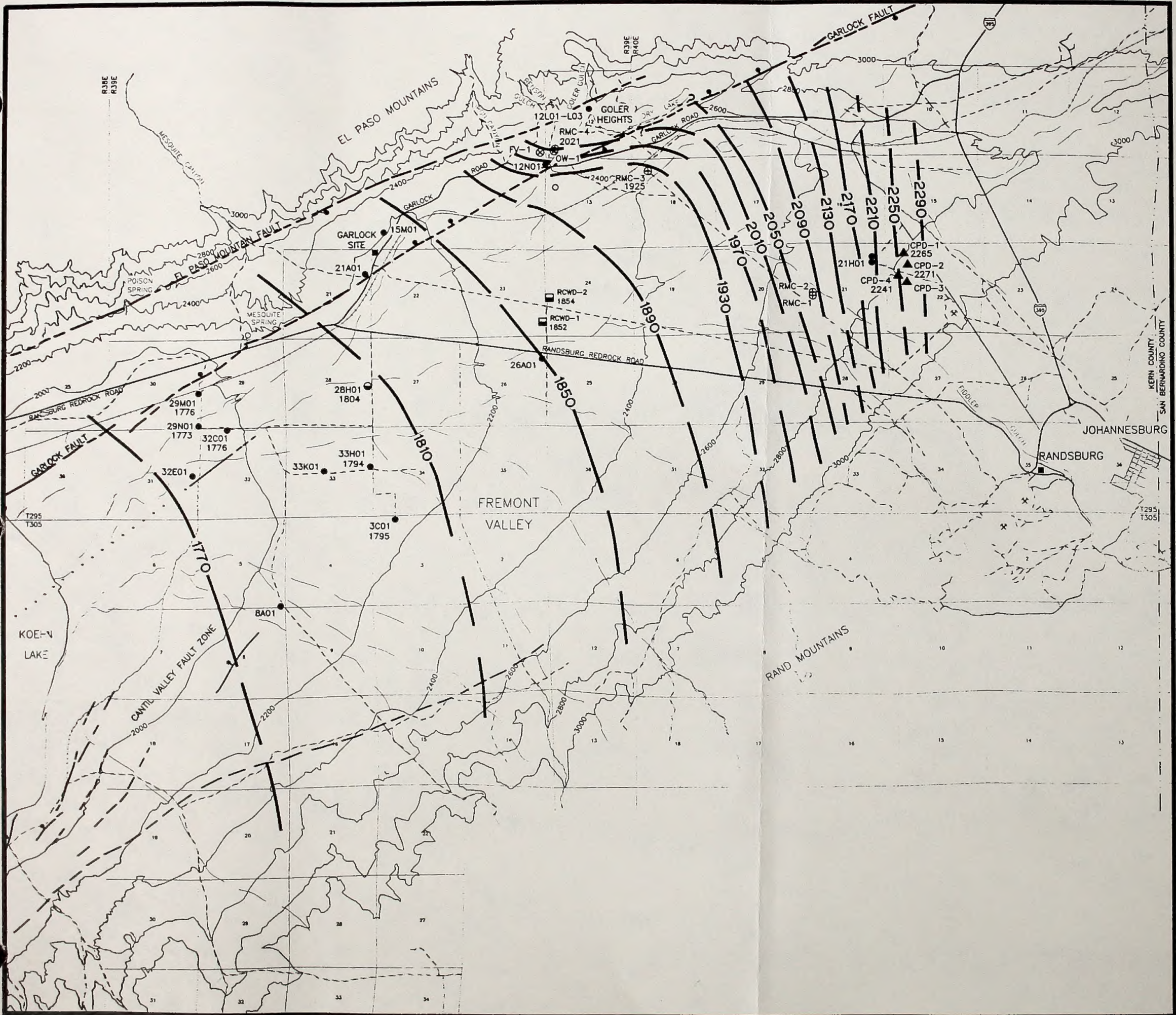
RAND MINING COMPANY

PROJECTED WATER LEVEL ELEVATIONS
AFTER 16 YEARS, MODEL CASE 4

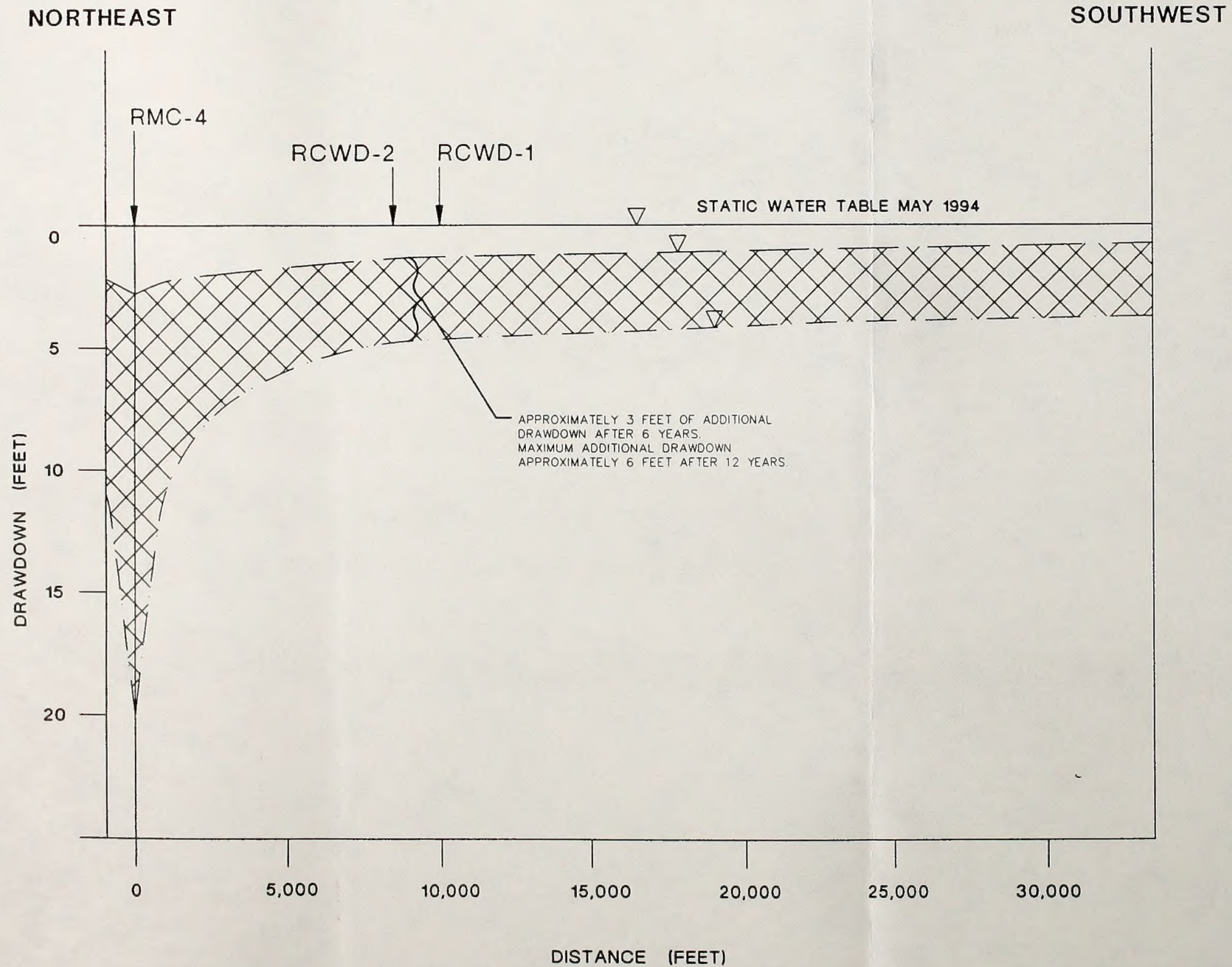
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FIGURE 16

PREP BY DAH REV BY TMT RPT NO. 945.03 220-0394 8



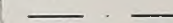
EXPLANATION



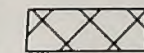
WATER TABLE



PROJECTED DRAWDOWN AFTER 6 YEARS WITHOUT INCREASED PUMPAGE DUE TO RAND PROJECT (MODEL CASE 1)



PROJECTED DRAWDOWN AFTER 6 YEARS WITH INCREASED PUMPAGE DUE TO RAND PROJECT (MODEL CASE 2)



ADDITIONAL DRAWDOWN CAUSED BY INCREASED RMC PUMPAGE

RMC : RAND MINING COMPANY
RCWD : RAND COMMUNITIES WATER DISTRICT

NOTE: PROJECTED DRAWDOWN BASED ON MODFLOW MODEL RESULTS FOR PRODUCTION WELL RMC-4 PUMPING ALONE

RAND MINING COMPANY

CROSS SECTION OF PROJECTED DRAWDOWN, MODEL CASES 1 AND 2



HARGIS + ASSOCIATES, INC.

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FIGURE 17

PREP BY DAH REV BY LMT RPT NO. 945 310-0104 8

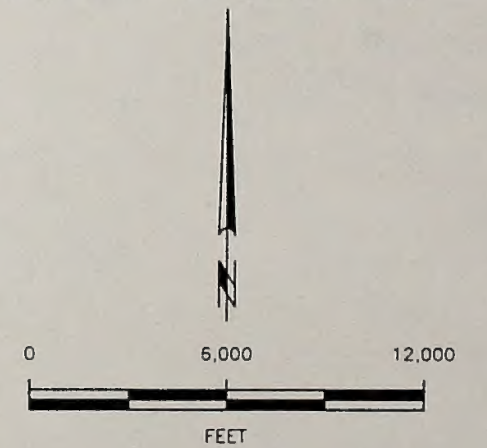
EXPLANATION

- RMC-4 RAND MINING COMPANY PRODUCTION WELL
- OW-1 RAND MINING COMPANY OBSERVATION WELL
- RCWD-2 RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2 CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 21H01 AGRICULTURAL PRODUCTION WELL
- 12N01 AGRICULTURAL OR INDUSTRIAL WELL
- OW-1 WATER LEVEL ELEVATION, IN FEET MEAN SEA LEVEL
- 2082

PROJECTED MIGRATION OF 500 MILLIGRAM PER LITER CONTOUR OF TOTAL DISSOLVED SOLIDS CONCENTRATION IN GROUNDWATER

- TDS < 500 mg/l AREA WHERE CONCENTRATION OF TOTAL DISSOLVED SOLIDS IN GROUNDWATER IS LESS THAN 500 MILLIGRAMS PER LITER
- TDS > 500 mg/l AREA WHERE CONCENTRATION OF TOTAL DISSOLVED SOLIDS IN GROUNDWATER IS GREATER THAN 500 MILLIGRAMS PER LITER

NOTES:
PROJECTED AMOUNT OF MIGRATION BASED ON PATH3D MODEL RESULTS. THESE RESULTS WERE BASED ON PRODUCTION WELL RMC-4 AND REGIONAL WELLS PUMPING. PROPOSED INCREASED PUMPAGE DUE TO RAND PROJECT IS INCLUDED.



RAND MINING COMPANY

PROJECTED CHANGE IN GROUNDWATER QUALITY
AFTER 16 YEARS, MODEL CASE 4

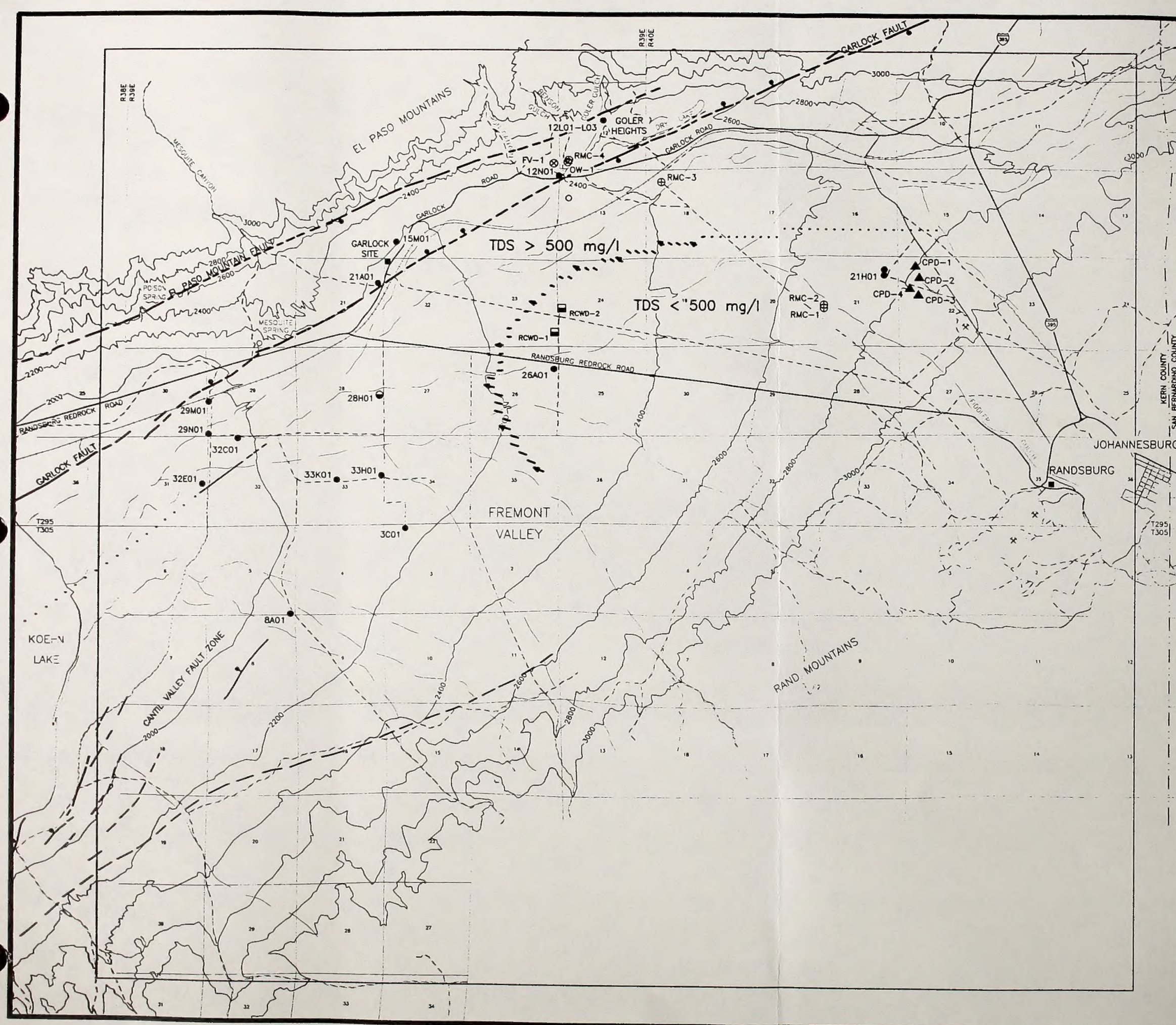


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FIGURE 18

PREP BY DAH REV BY TMT RPT NO. 945.03 210-0484 A





APPENDIX A

RESULTS OF GROUNDWATER AND SOIL SAMPLE ANALYSES

Hargis and Associates, Inc.
Attn.: Dixie Hambrick 818-563-4569

610 NORTH HOLLYWOOD WAY, SUITE 201
Burbank, CA 91505

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMICAL ANALYSES

Date of Report: 06/25/93 Lab Sample ID No.: 98-05625-1
Laboratory Signature of Stuart S. Ritham
Name: B C Laboratories, Inc. Lab Director
Name of Sampler Dixie Hambrick Employed By: Hargis and Associates, Inc.
Date/Time Sample Date/Time Sample Date Analysis
Collected: 06/10/93 Received @ Lab: 06/11/93 10:36AM Completed: 06/25/93
=====

System: System
Name: Hargis and Associates, Inc. Number: _____

Name or Number Of Sample Source: RMC-4

User ID: Station Number:
Date/Time of Sample: 9|3|0|6|1|0| Laboratory Code: 5|8|0|6|
 Y Y M M D D T T T T
Date Analyses Completed: 9|3|0|6|2|5|
 Y Y M M D D
Submitted by: _____ Phone #: _____

MCL	REPORTING UNITS	CONSTITUENT	ENTRY #	ANALYSES RESULTS	DLR
	mg/L	Total Hardness (as CaCO ₃)	00900	411.	
	mg/L	Calcium (Ca)	00916	84.	
	mg/L	Magnesium (Mg)	00927	49.	
	mg/L	Sodium (Na)	00929	123.	
	mg/L	Potassium (K)	00937	4.8	
Total Cations		meq/L Value: 13.7			
	mg/L	Total Alkalinity (as CaCO ₃)	00410	222.	
	mg/L	Hydroxide (OH)	71830	< 0.8	
	mg/L	Carbonate (CO ₃)	00445	< 2.6	
	mg/L	Bicarbonate (HCO ₃)	00440	271.	
*	mg/L +	Sulfate (SO ₄)	00945	439.	0.5
*	mg/L +	Chloride (Cl)	00940	18.3	
45	mg/L	Nitrate (NO ₃)	71850	2.7	
1.4-2.4	mg/L	Fluoride (F) Temp. Depend.	00951	0.57	0.1
Total Anions		meq/L Value: 14.2			
	Std Units	pH (Laboratory)	00403	7.7	
**	µmho/cm +	Specific Conductance (E.C.)	00095	1250.	
		Total Filterable Residue			
***	mg/L +	at 180 C (TDS)	70300	910.	
	UNITS	Apparent Color (Unfiltered)	00081	1.	
	TON	Odor Threshold at 60 C	00086	1.	
	NTU	Lab Turbidity	82079	2.1	
0.5	mg/L +	MBAS	38260	< 0.02	

* 250-500-600

** 900-1600-2200

*** 500-1000-15000

Recommended - Upper - Short Term

DATE 6/10 PAGE 1 OF 1

73

Hargis and Associates, Inc.
Attn.: Dixie Hambrick 818-563-4569

610 NORTH HOLLYWOOD WAY, SUITE 201
Burbank, CA 91505

Lab. #93-05625-1

INORGANIC CHEMICALS

Page 2 of 2

MCL	REPORTING UNITS	CONSTITUENT	ENTRY #	ANALYSES RESULTS	DLR μg/L
1000	μg/L	Aluminum (Al)	01105	< 50.	10.
50	μg/L	Arsenic (As)	01002	< 10.	5.
1000	μg/L	Barium (Ba)	01007	< 100.	100.
**** 10	μg/L	Cadmium (Cd)	01027	< 1.	1.
50	μg/L	Chromium (Total Cr)	01034	< 10.	7.
1000	μg/L +	Copper (Cu)	01042	< 10.	50.
300	μg/L +	Iron (Fe)	01045	74.	100.
50	μg/L	Lead (Pb)	01051	5.0	5.
50	μg/L +	Manganese (Mn)	01055	< 10.	30.
2	μg/L	Mercury (Hg)	71900	< 0.2	0.2
**** 10	μg/L	Selenium (Se)	01147	< 5.	2.
50	μg/L	Silver (Ag)	01077	< 10.	10.
5000	μg/L	Zinc (Zn)	01092	66.	50.

ADDITIONAL ANALYSES

	NTU	Field Turbidity	82078		
	C	Source Temperature	00010		
		Langelier Index Source Temp.	71814		
		Langelier Index at 60 C	71813		
	Std Units	Field pH	00400		
		Aggressiveness Index	82383		
	mg/L	Silica	00955		
	mg/L	Phosphate	00650		
	mg/L	Iodide	71865		
		Sodium Absorption Ration	00931		
****	MFL	Asbestos	81855		0.01
		Boron	01020		
	μg/L	Nitrate as N (Nitrogen)	00618		1000.
****	μg/L	Nitrate + Nitrite as N	A-029		1000.
****	μg/L	Nitrite as N (Nitrogen)	00620		50.
****	μg/L	Beryllium	01012		0.3
****	μg/L	Thallium	01059		1.
****	μg/L	Nickel	01067		5.
****	μg/L	Antimony	01097		3.
****	μg/L	Cyanide	01291		50.
	mg/L	Ammonia as N			

DLR = Detection Limit for Reporting purposes
+ = Indicates Secondary Drinking Water Standards
**** = New or Revised MCL is pending

610 NORTH HOLLYWOOD WAY, SUITE 201
Burbank, CA 91505

Date of Report: 06/22/93 Laboratory Name: B C Laboratories, Inc. Date/Time Sample Collected: 06/10/93

Lab Sample ID No.: 93-05625-1 Signature of Lab Director: [Signature] Employed By: Hargis and Associates, Inc. Date/Time Sample Received @ Lab: 06/11/93 10:36AM Date Analysis Completed: 06/16/93

Name or Number Of Sample Source: RMC-4

User ID: |_|_|_| Station Number: |_|_|_|_|_|_|_|_|_|_|_|_|_|_
Date/Time of Sample: |9|3|0|6|1|0||_|_|_| Laboratory Code: |5|8|0|6|

Y Y M M D D T T T

Date Analyses Completed: |9|3|0|6|1|6|

Y Y M M D D

Submitted by: _____ Phone #: _____

TEST METHOD	CONSTITUENT ALL CONSTITUENTS REPORTED $\mu\text{g/L}$	ENTRY #	ANALYSIS RESULTS	MCL $\mu\text{g/L}$	* DLR $\mu\text{g/L}$
502.2	Bromodichloromethane	32101	None Detected		0.2
502.2	Bromoform	32104	None Detected		0.2
502.2	Chloroform (Trichloromethane)	32106	None Detected		0.2
502.2	Dibromochloromethane	32105	None Detected		0.2
502.2	Total Trihalomethanes (THM's/THM)	82080	None Detected	100	0.2
502.2	Benzene	34030	None Detected	1	0.2
502.2	Carbon tetrachloride	32102	None Detected	0.5	0.2
502.2	Ethyl benzene	34371	None Detected	**680	0.2
502.2	1,4-Dichlorobenzene (p-DCB)	34571	None Detected	5	0.2
502.2	1,1-Dichloroethane (1,1-DCA)	34496	None Detected	5	0.2
502.2	1,2-Dichloroethane (1,2-DCA)	34531	None Detected	0.5	0.2
502.2	1,1-Dichloroethylene (1,1-DCE)	34501	None Detected	** 6	0.2
502.2	cis-1,2-Dichloroethylene	77093	None Detected	6	0.2
502.2	trans-1,2-Dichloroethylene	34546	None Detected	10	0.2
502.2	1,2-Dichloropropane	34541	None Detected	5	0.2
502.2	Total 1,3-Dichloropropene	34561	None Detected	0.5	0.2
502.2	Monochlorobenzene (Chlorobenzene)	34301	None Detected	**30	0.2
502.2	1,1,2,2-Tetrachloroethane	34516	None Detected	1	0.2
502.2	Tetrachloroethylene (PCE)	34475	0.35	5	0.2
502.2	1,1,1-Trichloroethane (1,1,1-TCA)	34506	0.62	200	0.2
502.2	1,1,2-Trichloroethane (1,1,2-TCA)	34511	None Detected	**32	0.2
502.2	Trichloroethylene (TCE)	39180	None Detected	5	0.2

* Detection Limit for Reporting purposes

Hargis and Associates, Inc.
 Attn.: Dixie Hambrick 818-563-4569

610 NORTH HOLLYWOOD WAY, SUITE 201
 Burbank, CA 91505

Lab. #93-05625-1

REGULATED ORGANIC CHEMICALS (CONTINUED)

Page 2 of 3

TEST METHOD	CONSTITUENT ALL CONSTITUENTS REPORTED $\mu\text{g/L}$	ENTRY #	ANALYSIS RESULTS	MCL $\mu\text{g/L}$	* DRL $\mu\text{g/L}$
502.2	Trichlorofluoromethane (Freon 11)	34488	None Detected	150	0.2
502.2	Trichlorotrifluoroethane (Freon 113)	81611	None Detected	1200	0.2
502.2	Vinyl Chloride (VC)	39175	None Detected	0.5	0.2
	m,p-Xylene	A-014			
	o-Xylene	77135			
502.2	Total Xylenes (m,p. & o)	81551	None Detected	1750	0.2
	Dibromochloropropane (DBCP)	38761		0.2	
	Ethylene Dibromide (EDB)	77651		0.02	
	Endrin	39390		** 0.2	
	Lindane (gamma-BHC)	39340		** 4	
	Methoxychlor	39480		**100	
	Toxaphene	39400		** 5	
	Chlordane	39350		0.1	
	Diethylhexylphthalate (DEHP)	39100		4.	
	Heptachlor	39410		0.01	
	Heptachlor epoxide	39420		0.01	
	Atrazine (AAtrex)	39033		3	
	Molinate (Ordram)	82199		20	
	Simazine (Princep)	39055		**10	
	Thiobencarb (Bolero)	A-001		70	
	Bentazon (Basagran)	38710		18	
	2,4-D	39730		**100	
	2,4,5-TP (Silvex)	39045		**10	
	Carbofuran (Furadan)	81405		18	
	Glyphosate	79743		700	

UNREGULATED ORGANIC CHEMICALS

	Bromobenzene	81555			
	Bromochloromethane	A-012			
502.2	Bromomethane (Methyl Bromide)	34413	None Detected		0.2
	n-Butylbenzene	A-010			
	sec-Butylbenzene	77350			
	tert-Butylbenzene	77353			
502.2	Chloroethane	34311	None Detected		0.2
502.2	2-Chloroethylvinyl ether	34576	None Detected		0.2
502.2	Chloromethane (Methyl Chloride)	34418	None Detected		0.2
	2-Chlorotoluene	A-008			
	4-Chlorotoluene	A-009			
	Dibromomethane	77596			
502.2	1,2-Dichlorobenzene (o-DCB)	34536	None Detected	**	0.2
502.2	1,3-Dichlorobenzene (m-DCB)	34566	None Detected		0.2
502.2	Dichlorodifluoromethane	34668	None Detected		0.2
502.2	Dichloromethane (Methylene Chloride)	34423	None Detected	**	0.4
	1,3-Dichloropropane	77173			
	2,2-Dichloropropane	77170			
	1,1-Dichloropropene	77168			
	Hexachlorobutadiene	34391			
	Isopropylbenzene (Cumene)	77223			
	p-Isopropyltoluene	A-011			
	Naphthalene	34696			
	n-Propylbenzene	77224			
	Styrene	77128		**	

Lab. #93-05625-1

UNREGULATED ORGANIC CHEMICALS (CONTINUED)

Page 3 of

TEST METHOD	CONSTITUENT ALL CONSTITUENTS REPORTED $\mu\text{g/L}$	ENTRY #	ANALYSIS RESULTS	MCL $\mu\text{g/L}$	* DRL $\mu\text{g/L}$
	1,1,1,2-Tetrachloroethane	77562			
502.2	Toluene	34010	None Detected	**	0.2
	1,2,3-Trichlorobenzene	77613			
	1,2,4-Trichlorobenzene	34551		**	
	1,2,3-Trichloropropane	77443			
	1,2,4-Trimethylbenzene	77222			
	1,3,5-Trimethylbenzene	77226			
	Methyl Ethyl Ketone (MEK, Butanone)	81595			
	Methyl Isobutyl Ketone (MIBK)	81596			
	bis (2-Chloroethyl) Ether	34273			
	Alachlor (Alanex)	77825		**	
	Aldicarb (Temik)	39053			
	Aldrin	39330			
	Benzo (a) pyrene	34247		**	
	Bromacil (Hyvar)	82198			
	Butachlor	77860			
	Carbaryl (Sevin)	77700			
	Chlorothalonil (Daconil, Bravo)	70314			
	Dalapon	38432		**	
	Diazinon	39570			
	Dicamba (Banvel)	82052			
	Dieldrin	39380			
	Dimethoate (Cygon)	38458			
	Dinoseb (DNBP)	81287		**	
	Diquat	78885		**	
	Di (2-ethylhexyl) adipate	A-026		**	
	Diuron	39650			
	Endothall	38926		**	
	Hexachlorobenzene	39700		**	
	Hexachlorocyclopentadiene	34386		**	
	3-Hydroxycarbofuran	A-021			
	Methomyl	39051			
	Metolachlor	39356			
	Oxamyl (Vydate)	38865		**	
	Pentachlorophenol (PCP)	39032		**	
	Picloram	39720		**	
	Polychlorinated Biphenyls (Total PCB's)	39516		**	
	Prometryn (Caparol)	39057			
	Propachlor	38533			
	2,3,7,8-TCDD (Dioxin)	34676		**	

** = New or Revised MCL is pending

California D.O.H.S. Cert. #1186

Laboratory comments and description of any additional compounds found:

Confirmation impossible due to small amount of sample received. (Only oneVOA vial)

610 NORTH HOLLYWOOD WAY, SUITE 201
Burbank, CA 91505

Date of Report: 06/22/93 Lab Sample ID No.: 93-05625-1TB
 Laboratory _____ Signature of _____
 Name: B C Laboratories, Inc. Lab Director [Signature]
 Name of Sampler _____ Employed By: Hargis and Associates, Inc.
 Date/Time Sample _____ Date/Time Sample _____ Date Analysis _____
 Collected: 06/07/93 Received @ Lab: 06/11/93 10:36AM Completed: 06/16/93

Name or Number Of Sample Source: RMC-4 TRAVEL BLANK

REGULATED ORGANIC CHEMICALS

* Detection Limit for Reporting purposes

Lab. #93-05625-1TB

REGULATED ORGANIC CHEMICALS (CONTINUED)

Page 2 of 1

TEST METHOD	CONSTITUENT ALL CONSTITUENTS REPORTED $\mu\text{g/L}$	ENTRY #	ANALYSIS RESULTS	MCL $\mu\text{g/L}$	* DRL $\mu\text{g/L}$
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502.2	Vinyl Chloride (VC)	39175	None Detected	0.5	0.2
502.2	m,p-Xylene	A-014	None Detected		0.2
502.2	o-Xylene	77135	None Detected		0.2
502.2	Total Xylenes (m,p, & o)	81551	None Detected	1750	0.2
	Dibromochloropropane (DBCP)	38761		0.2	
	Ethylene Dibromide (EDB)	77651		0.02	
	Endrin	39390		** 0.2	
	Lindane (gamma-BHC)	39340		** 4	
	Methoxychlor	39480		**100	
	Toxaphene	39400		** 5	
	Chlordane	39350		0.1	
	Diethylhexylphthalate (DEHP)	39100		4	
	Heptachlor	39410		0.01	
	Heptachlor epoxide	39420		0.01	
	Atrazine (AAtrex)	39033		3	
	Molinate (Ordram)	82199		20	
	Simazine (Princep)	39055		**10	
	Thiobencarb (Bolero)	A-001		70	
	Bentazon (Basagran)	38710		18	
	2,4-D	39730		**100	
	2,4,5-TP (Silvex)	39045		**10	
	Carbofuran (Furadan)	81405		18	
	Glyphosate	79743		700	

UNREGULATED ORGANIC CHEMICALS

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	Bromochloromethane	A-012			
502.2	Bromomethane (Methyl Bromide)	34413	None Detected		0.2
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502.2	Chloroethane	34311	None Detected		0.2
502.2	2-Chloroethylvinyl ether	34576	None Detected		0.2
502.2	Chloromethane (Methyl Chloride)	34418	None Detected		0.2
	2-Chlorotoluene	A-008			
	4-Chlorotoluene	A-009			
	Dibromomethane	77596			
502.2	1,2-Dichlorobenzene (o-DCB)	34536	None Detected	**	0.2
502.2	1,3-Dichlorobenzene (m-DCB)	34566	None Detected		0.2
502.2	Dichlorodifluoromethane	34668	None Detected		0.2
502.2	Dichloromethane (Methylene Chloride)	34423	None Detected	**	0.4
	1,3-Dichloropropane	77173			
	2,2-Dichloropropane	77170			
	1,1-Dichloropropene	77168			
	Hexachlorobutadiene	34391			
	Isopropylbenzene (Cumene)	77223			
	p-Isopropyltoluene	A-011			
	Naphthalene	34696			
	n-Propylbenzene	77224			
	Styrene	77128		**	

Hargis and Associates, Inc.
Attn.: Dixie Hambrick 818-563-4569

610 NORTH HOLLYWOOD WAY, SUITE 201
Burbank, CA 91505

Lab. #93-05625-1TB

UNREGULATED ORGANIC CHEMICALS (CONTINUED)

Page 3 of 3

TEST METHOD	CONSTITUENT ALL CONSTITUENTS REPORTED $\mu\text{g/L}$	ENTRY #	ANALYSIS RESULTS	MCL $\mu\text{g/L}$	* DRL * $\mu\text{g/L}$
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	1,2,3-Trichlorobenzene	77613			
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	Methyl Isobutyl Ketone (MIBK)	81596			
	bis (2-Chloroethyl) Ether	34273			
	Alachlor (Alanex)	77825		**	
	Aldicarb (Temik)	39053			
	Aldrin	39330			
	Benzo (a) pyrene	34247		**	
	Bromacil (Hyvar)	82198			
	Butachlor	77860			
	Carbaryl (Sevin)	77700			
	Chlorothalonil (Daconil, Bravo)	70314			
	Dalapon	38432		**	
	Diazinon	39570			
	Dicamba (Banvel)	82052			
	Dieldrin	39380			
	Dimethoate (Cygon)	38458			
	Dinoseb (DNBP)	81287		**	
	Diquat	78885		**	
	Di (2-ethylhexyl) adipate	A-026		**	
	Diuron	39650			
	Endothall	38926		**	
	Hexachlorobenzene	39700		**	
	Hexachlorocyclopentadiene	34386		**	
	3-Hydroxycarbofuran	A-021			
	Methomyl	39051			
	Metoalachlor	39356			
	Oxamyl (Vydate)	38865		**	
	Pentachlorophenol (PCP)	39032		**	
	Picloram	39720		**	
	Polychlorinated Biphenyls (Total PCB's)	39516		**	
	Prometryn (Caparol)	39057			
	Propachlor	38533			
	2,3,7,8-TCDD (Dioxin)	34676		**	

** = New or Revised MCL is pending

California D.O.H.S. Cert. #1186

Laboratory comments and description of any additional compounds found:

B C LABORATORIES
QUALITY CONTROL REPORT - LEVEL II
(Instrumental & Blank Parameters)

Hargis and Associates, Inc.
610 NORTH HOLLYWOOD WAY, SUITE 201
Burbank, CA 91505
Dixie Hambrick

Date of Report: 06/29/93
Sample Matrix: WATER

Samples Affected: 93-05625 - 1

[illegible]

B C LABORATORIES

QUALITY CONTROL REPORT - LEVEL II
(Instrumental & Blank Parameters)

Hargis and Associates, Inc.
610 NORTH HOLLYWOOD WAY, SUITE 201
Burbank, CA 91505
Dixie Henbrick

Date of Report: 06/29/93
Sample Matrix: WATER

Samples Affected: 93-05625 - 1

ICV = Initial Calibration Verification; CCV = Continuing Calibration Verification
CCB = Continuing Calibration Blank

Quality Control Officer





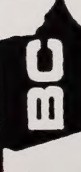
QUALITY CONTROL REPORT - LEVEL II
(Precision & Accuracy)

Hargis and Associates, Inc.
610 NORTH HOLLYWOOD WAY, SUITE 201
Burbank, CA 91505
Dixie Hambrick

Date of Report: 06/29/93
Sample Matrix: WATER

Samples Affected: 93-05625 - 1

Constituents	QC Sample ID	Sample Result	Sample Duplicate	MS Result	MSD Result	MS Spike Level	MSD Spike Level	Units	Sample Spike R.P.D. R.P.D.	Precision Control Limits	MS % Rec	MSD % Rec	Accuracy Control Limits
Calcium	5624-1	27.8	28.1	36.3	37.0	10.0	10.0	mg/L	1.1 1.9	10 83	90	90	75 - 119
Sodium	5624-1	25.3	25.4	71.8	71.6	50.0	50.0	mg/L	0.4 0.3	10 92	92	92	77 - 115
Potassium	5624-1	3.0	3.0	7.6	7.6	5.0	5.0	mg/L	0.0 0.0	11 92	92	92	72 - 119
Magnesium	5624-1	6.0	6.1	11.5	11.5	5.0	5.0	mg/L	1.7 0.0	10 110	110	110	80 - 120
Chloride	5625-1	18.3	18.6	121.0	121.0	100.0	100.0	mg/L	1.6 0.0	10 103	103	103	88 - 107
Sulfate	5625-1	439.0	439.0	538.0	540.0	100.0	100.0	mg/L	0.0 0.4	10 97	97	97	87 - 105
Nitrate/Nitrite as N	5596-11	< 0.1	< 0.1	2.0	2.0	2.0	2.0	mg/L	<POL 0.0	10 100	100	100	71 - 116
Fluoride	5553-1	0.42	0.42	0.50	0.50	0.10	0.10	mg/L	4.6 3.9	10 80	80	80	80 - 120
pH	5625-1	7.7	7.7					PH U	0.0	±0.1 PH U			
Electrical Conductivity @ 25 C	5625-1	1250.0	1250.0					UMHO/CM	0.0	10			
Total Dissolved Solids @ 180 C	5660-1	3280	3290					mg/L	0.3	10			
Bicarbonate	5625-1	2.44	2.43	3.79	3.78	1.33	1.33	mls titr	0.4 0.3	20 101	101	101	80 - 120
Aluminum	5625-1	< 50	< 50	109	112	100	100	µg/L	<POL 2.7	20 85	85	88	75 - 125
Arsenic	5660-3	< 2.0	< 2.0	10.3	10.5	10.0	10.0	µg/L	<POL 1.9	20 103	103	105	75 - 125
Barium	5625-1	18	18	72	68	50	50	µg/L	<POL 5.7	20 108	100	100	82 - 107
Cadmium	5553-1	< 0.1	< 0.1	3.82	3.83	4.000	4.000	µg/L	<POL 0.3	15 96	96	96	75 - 125
Chromium	5625-1	< 10	< 10	50	49	50	50	µg/L	<POL 2.0	20 100	98	98	75 - 125
Copper	5625-1	< 10	< 10	56	49	50	50	µg/L	<POL 13.3	20 107	93	93	75 - 113
Iron	5625-1	74	68	131	128	50	50	µg/L	<POL 3.9	20 114	104	104	75 - 125
Lead	5596-9	0.11	0.05	9.56	9.33	10.0	10.0	µg/L	<POL 2.4	20 95	92	92	75 - 125
Manganese	5625-1	< 10.0	< 10.0	55	52	50	50	µg/L	<POL 5.6	11 98	92	92	76 - 112
Mercury	5782-2 x2	< 0.2	< 0.2	0.98	0.95	0.80	0.80	µg/L	<POL 3.1	13 120	116	116	75 - 125
Selenium	5660-3	< 2.0	< 2.0	10.2	10.2	10.0	10.0	µg/L	<POL 0.0	20 102	102	102	75 - 125
Silver	5625-1	< 10	< 10	52	49	50	50	µg/L	<POL 5.9	20 94	88	88	75 - 125
Zinc	5625-1	66	64	128	116	50	50	µg/L	<POL 9.8	20 124	100	100	75 - 125
MBAS	5625-1	0.02	0.02	0.43	0.40	0.40	0.40	mg/L	<POL 7.2	10 102	95	95	79 - 114



ANALYTICAL

B C LABORATORIES

QUALITY CONTROL REPORT - LEVEL II
(Precision & Accuracy)

Hargis and Associates, Inc.
610 NORTH HOLLYWOOD WAY, SUITE 201
Burbank, CA 91505
Dixie Hambrick

Samples Affected: 93-05625 - 1

Date of Report: 06/29/93
Sample Matrix: WATER

MS = Matrix Spike; MSD = Matrix Spike Duplicate; RPD = Relative Percent Difference

Quality Control Officer

QUALITY CONTROL REPORT
(Instrumental & Blank Parameters)
METHOD 502.2

Hargis and Associates, Inc.
610 NORTH HOLLYWOOD WAY, SUITE 201
Burbank, CA 91505
Dixie Hambrick

Date of Report: 06/29/93
Sample Matrix: WATER

Samples Affected: 93-05625 - 1

Constituents	CCB Readings Before		CCB Readings After		Method Blank Readings	
	Units		Units		Units	
Method 502.2 compounds	< 0.2		< 0.2		< 0.2	
	µg/L		µg/L		µg/L	

CCB = Continuing Calibration Blank

Quality Control Officer

Chas. J. Butler

6/15/93 18:42

BC LABORATORIES INC

INITIAL CALIBRATION

V394

EPA 502.2

ANALYST: BJM

Instrument: V3400 GCVII

COMPOUND	CF(1)	CF(2)	CF(3)	CF(4)	CF(5)	CF(AVE)	%RSD
	[AC/(ug/L)/I.S.]\[ug/L]						
CCL2F2	0.24	0.27	0.30	0.32	0.30	0.285	10.23
	3.73	7.47	10.67	13.87	17.60		
CH3CL	0.30	0.35	0.38	0.41	0.41	0.369	11.76
	3.73	7.47	10.67	13.87	17.60		
VCL	0.53	0.57	0.62	0.61	0.62	0.590	5.42
	3.73	7.47	10.67	13.87	17.60		
CH3BF	0.16	0.21	0.25	0.27	0.28	0.234	18.31
	3.73	7.47	10.67	13.87	17.60		
C2H5CL	0.70	0.66	0.70	0.67	0.61	0.669	4.93
	3.73	7.47	10.67	13.87	17.60		
CCL3F	1.50	1.32	1.12	0.94		1.219	17.24
	3.73	7.47	10.67	13.87	17.60		
1.1-DCE	0.75	0.73	0.81	0.83	0.82	0.787	4.97
	0.93	1.87	2.67	3.47	4.40		
C2CL3F3	0.82	0.79	0.83	0.85	0.80	0.821	2.73
	0.93	1.87	2.67	3.47	4.40		
MECL2	1.30	1.09	1.02	0.95	0.93	1.056	12.78
	0.93	1.87	2.67	3.47	4.40		
T-1.2-DCE	0.82	0.80	0.86	0.85	0.76	0.818	4.38
	0.93	1.87	2.67	3.47	4.40		
1.1-DCA	0.81	0.78	0.83	0.83	0.79	0.808	2.39
	0.93	1.87	2.67	3.47	4.40		
C-1.2-DCE	0.76	0.73	0.65	0.56	0.49	0.638	15.42
	1.87	3.73	5.33	6.93	8.80		
IS-1 (elcd)	0.58	0.61	0.56	0.58	0.61	0.588	3.41
	1.7	1.7	1.7	1.7	1.7		
CHCL3	1.05	0.90	0.74	0.66		0.837	17.73
	1.87	3.73	5.33	6.93	8.80		
1.1.1-TCA	1.07	0.97	1.03	0.96	0.83	0.972	8.52
	0.93	1.87	2.67	3.47	4.40		
CCL4	1.24	1.15	1.24	1.17	1.04	1.169	6.28
	0.93	1.87	2.67	3.47	4.40		
1.2-DCA	0.59	0.52	0.47	0.44	0.46	0.496	10.58
	0.93	1.87	2.67	3.47	4.40		
TCE	0.97	0.90	0.97	0.91	0.80	0.909	6.64
	0.93	1.87	2.67	3.47	4.40		
1.2-DCPA	0.64	0.61	0.61	0.59	0.61	0.612	2.39
	0.93	1.87	2.67	3.47	4.40		
CHBRCL2	0.46	0.46	0.46	0.44	0.43	0.457	3.85
	1.87	3.73	5.33	6.93	8.80		
2-CEVE	0.051	0.054	0.044	0.043	0.049	0.0485	8.31

	3.73	7.47	10.67	13.87	17.60		
C-1.3-DCPE	0.609	0.578	0.541	0.525	0.519	0.554	6.15
	0.97	1.94	2.77	3.61	4.58		
T-1.3-DCPE	0.299	0.300	0.267	0.267	0.294	0.285	5.31
	0.90	1.79	2.56	3.33	4.22		
1.1.2-TCA	0.367	0.374	0.325	0.310	0.345	0.344	7.05
	0.93	1.87	2.67	3.47	4.40		
TETRA CEE (PCE)	1.13	1.07	1.12	1.03	0.90	1.051	8.19
	0.93	1.87	2.67	3.47	4.40		
CHBR2CL	0.212	0.246	0.223	0.228	0.256	0.233	6.85
	1.87	3.73	5.33	6.93	8.80		
CHBR3	0.095	0.110	0.098	0.096	0.118	0.103	8.79
	3.73	7.47	10.67	13.87	17.60		
1.1.2.2-TCA	0.202	0.205	0.169	0.161	0.189	0.185	9.36
	0.93	1.87	2.67	3.47	4.40		
BENZENE	0.148	0.145	0.162	0.168	0.166	0.158	5.97
	0.93	1.87	2.67	3.47	4.40		
TOLUENE	0.146	0.136	0.150	0.154	0.152	0.148	4.44
	0.93	1.87	2.67	3.47	4.40		
CHLRBENZ	0.123	0.122	0.130	0.133	0.139	0.129	4.91
	0.93	1.87	2.67	3.47	4.40		
ETH BENZ	0.120	0.115	0.133	0.138	0.137	0.129	7.19
	0.93	1.87	2.67	3.47	4.40		
M+P-XYL	0.158	0.156	0.175	0.179	0.177	0.169	5.88
	1.87	3.73	5.33	6.93	8.80		
O-XYL	0.116	0.110	0.123	0.125	0.128	0.120	5.37
	0.93	1.87	2.67	3.47	4.40		
IS-2 (PID)	0.31	0.29	0.30	0.29	0.29	0.294	2.75
	3.4	3.4	3.4	3.4	3.4		
1.3-DCB	0.098	0.095	0.099	0.100	0.107	0.100	3.83
	0.93	1.87	2.67	3.47	4.40		
1.4-DCB	0.086	0.084	0.085	0.086	0.093	0.087	3.88
	0.93	1.87	2.67	3.47	4.40		
1.2-DCB	0.062	0.062	0.059	0.058	0.065	0.062	4.23
	0.93	1.87	2.67	3.47	4.40		

6/15/93 18:42

BC LABORATORIES INC.

6/15/93 20:10

INITIAL CALIBRATION VERIFICATION

ANALYST: BJM

EPA 502.2

Instrument: V3400 GCVII

6/15/93 18:42

COMPOUND	CF(AVE)	CF(DAILY)	% RPD
CCL2F2	0.285	0.279	2.23
[AC/(ug/L)/1.S.]			
CH3CL	0.369	0.362	1.97
VCL	0.590	0.579	1.82
CH3BR	0.234	0.230	1.75
C2H5CL	0.669	0.573	15.51
CCL3F	1.219	1.092	11.04
1,1-DCE	0.787	0.735	6.91
C2CL3F3	0.821	0.766	6.90
MECL2	1.056	0.965	9.00
T-1,2-DCE	0.818	0.796	2.72
1,1-DCA	0.909	0.775	4.08
C-1,2-DCE	0.633	0.646	1.23
IS-1 (ELCD)	0.59	0.56	4.10
CHCL3	0.837	0.734	13.13
1,1,1-TCA	0.972	1.004	3.26
CCL4	1.169	1.161	0.65
1,2-DCA	0.496	0.433	13.44
TCE	0.909	0.904	0.65
1,2-DCFA	0.612	0.561	8.75
CHBRCL2	0.457	0.435	4.91
2-CEVE	0.049	0.042	15.51

C-1,3-DCPE	0.554	0.507	8.94
T-1,3-DCPE	0.285	0.256	10.84
1,1,2-TCA	0.344	0.301	13.45
TETRA CEE (PCE)	1.051	1.061	1.02
CHBR2CL	0.233	0.212	9.37
CHBR3	0.103	0.092	11.81
1,1,2,2-TCA	0.185	0.158	16.15
BENZENE	0.158	0.149	6.05
TOLUENE	0.148	0.137	7.20
CHLRBENZ	0.129	0.118	8.91
ETH BENZ	0.129	0.120	6.98
M+P-XYL	0.169	0.160	5.72
O-XYL	0.120	0.112	7.38
IS-2 (PID)	0.29	0.30	0.65
1,3-DCB	0.100	0.089	11.87
1,4-DCB	0.087	0.080	7.88
1,2-DCB	0.062	0.055	11.46

6/15/93 20:10

INITIAL CALIBRATION VERIFICATION

-

6/16/93 17:10

CONTINUING CALIBRATION VERIFICATION

BEGIN

ANALYST: BJM

EPA 502.2

Instrument: V3400 GCVII

6/15/93 18:42

COMPOUND	CF(AVE)	CF(DAILY)	% RPD
CCL2F2	0.285	0.315	9.93
	[AC/(ug/L)/I.S.]		
CH3CL	0.369	0.455	20.85
VCL	0.590	0.689	15.54
CH3BR	0.234	0.283	20.45
C2H5CL	0.669	0.731	8.86
CCL3F	1.219	1.204	1.27
1,1-DCE	0.787	0.877	10.77
C2CL3F3	0.821	0.837	7.83
MECL2	1.056	0.888	17.24
T-1,2-DCE	0.318	0.398	9.30
1,1-DCA	0.808	0.863	6.63
C-1,2-DCE	0.638	0.703	9.70
IS-1 (ELCD)	0.59	0.52	12.52
CHCL3	0.837	0.802	4.21
1,1,1-TCA	0.972	1.106	12.91
CCL4	1.169	1.331	12.99
1,2-DCA	0.496	0.485	2.24
TCE	0.909	1.021	11.59
1,2-DCPA	0.612	0.633	3.28
CHBRCL2	0.457	0.473	3.32
2-CEVE	0.049	0.043	12.15

C-1.3-DCPE	0.554	0.572	3.20
T-1.3-DCPE	0.285	0.291	2.04
1.1.2-TCA	0.344	0.353	2.36
TETRA CEE (PCE)	1.051	1.221	15.04
CHBR2CL	0.233	0.227	2.87
CHBR3	0.103	0.101	2.51
1.1.2.2-TCA	0.185	0.184	0.48
BENZENE	0.158	0.159	0.87
TOLUENE	0.148	0.144	2.32
CHLRBENZ	0.129	0.128	1.35
ETH BENZ	0.129	0.131	1.77
M+P-XYL	0.169	0.174	2.76
O-XYL	0.120	0.120	0.15
IS-2 (PID)	0.29	0.27	7.97
1.3-DCB	0.100	0.097	2.53
1.4-DCB	0.087	0.083	3.93
1.2-DCB	0.062	0.060	2.47

6/16/93 17:10

CONTINUING CALIBRATION VERIFICATION
EPA 502.2

- BEGIN

CONTINUING CALIBRATION VERIFICATION

6/17/93 230

END

EPA 502.2

Instrument: V3400 GCVII

ANALYST: BJM

6/15/93 18:42

	CF(AVE)	CF(DAILY)	% RPD
CCL2F2	0.285	0.298	4.41
	[AC/(ug/L)/I.S.]		
CH3CL	0.369	0.370	0.07
VCL	0.590	0.652	9.95
CH3BR	0.234	0.269	13.56
C2H5CL	0.669	0.698	4.25
CCL3F	1.219	1.150	5.05
1.1-DCE	0.787	0.833	5.71
C2CL3F3	0.321	0.811	1.19
MECL2	1.056	0.849	21.78
T-1.2-DCE	0.313	0.355	4.49
1.1-DCA	0.808	0.820	1.46
C-1.2-DCE	0.633	0.675	5.67
IS-1 (ELCD)	0.59	0.54	8.91
CHCL3	0.337	0.767	3.66
1.1.1-TCA	0.972	1.078	10.32
CCL4	1.169	1.257	7.27
1.2-DCA	0.496	0.456	8.29
TCE	0.909	0.963	5.77
1.2-DCPA	0.612	0.604	1.45
CHBRCL2	0.457	0.471	3.04
2-CEVE	0.049	0.045	7.26

C-1,3-DCPE	0.554	0.517	6.93
T-1,3-DCPE	0.285	0.257	10.27
1,1,2-TCA	0.344	0.320	7.41
TETRA CEE (PCE)	1.051	1.106	5.16
CHBR2CL	0.233	0.223	4.35
CHBR3	0.103	0.101	2.58
1,1,2,2-TCA	0.185	0.163	12.85
BENZENE	0.158	0.159	0.52
TOLUENE	0.148	0.143	3.00
CHLOROBENZ	0.129	0.129	0.52
ETHYL BENZ	0.129	0.129	0.37
M+P-XYLENE	0.169	0.172	1.45
O-XYLENE	0.120	0.119	1.18
IS-2 (PID)	0.29	0.26	12.73
1,3-DCB	0.100	0.097	2.89
1,4-DCB	0.087	0.083	4.61
1,2-DCB	0.062	0.060	3.45

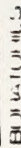
6/17/93 2:30

CONTINUING CALIBRATION VERIFIC - END
EPA 502.2

Date of Report: 06/29/93
Sample Matrix: WATER

Sample Matrix: WATER

THE UNIVERSITY OF CHICAGO PRESS



Date of Report: 06/29/93
Sample Matrix: WATER

Samples Affected: 93-05625 - 1

Constituents	QC Sample ID	Sample Result	MS Result	MSD Result	MS Spike Level	MSD Spike Level	Spike R.P.D.	Precision Control Limits	MS % Rec	MSD % Rec	Accuracy Control Limits
Dichlorodifluoromethane	Bl Water	< 0.2	12.2	12.0	10.7	10.7	1.5	20	114.	112.	80 - 120
Methylene Chloride	Bl Water	< 0.2	2.29	2.23	2.67	2.67	2.8	20	86.	84.	80 - 120
Toluene	Bl Water	< 0.2	2.60	2.65	2.67	2.67	1.9	20	97.	99.	75 - 116

MS = Matrix Spike; MSD = Matrix Spike Duplicate; RPD = Relative Percent Difference

Quality Control Officer

Wm. L. G. Smith

8411 Gothard Street, Unit F
Huntington Beach, California 92648
Telephone: (714) 842-7011 / Fax: (714) 842-3735

May 18, 1994

Hargis & Associates, Inc.
610 N. Hollywood Way
Suite 201
Burbank, CA 91505

Attention: Ms. Dixie A. Hambrick
Subject: Report/Laboratory Testing Results
Project Name: RMC
Project No.: 945.06
TETC Project No.: 94-371-05702

Dear Ms. Hambrick:

Enclosed please find laboratory testing results for the samples from the RMC project. The analyses performed on the samples from the above project were conducted in general accordance with the ASTM standard testing procedures listed below.

TYPE OF TEST

Grain Size Analysis

Moisture and Density

TEST PROCEDURE

ASTM D 422

ASTM D 2937

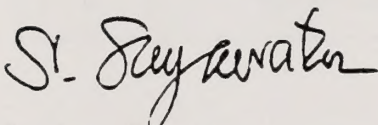
Test results are presented in the Table 1 and Figures attached.

ASTM: American Society for Testing and Materials, Annual Book of ASTM Standard, Section 4, Volume 04.08 Soil and Rock; Dimension Stone; Geosynthetics, 1993.

Thank you for selecting The Earth Technology Corporation to provide laboratory testing services to Hargis & Associates, Inc. Please feel free to contact us if you should have any questions concerning these results.

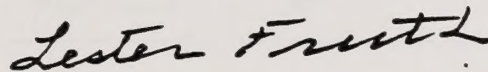
Very truly yours,

THE EARTH TECHNOLOGY CORPORATION
Laboratory Testing Services



Somboon Sayawatana
Staff Engineer II

Enclosures



Lester Fruth, Ph.D.
Manager, Geomechanics Laboratories

18411 Gothard Street, Unit F
Huntington Beach, California 92648
Telephone: (714) 842-7011 / Fax: (714) 842-3735

PROJECT NAME: RMC

TETC NO.: 94-371-05702

PROJECT NO.: 945.06

SUMMARIZED BY: S.S.

CLIENT: Hargis & Associates, Inc.

DATE: 05/18/94

TABLE 1

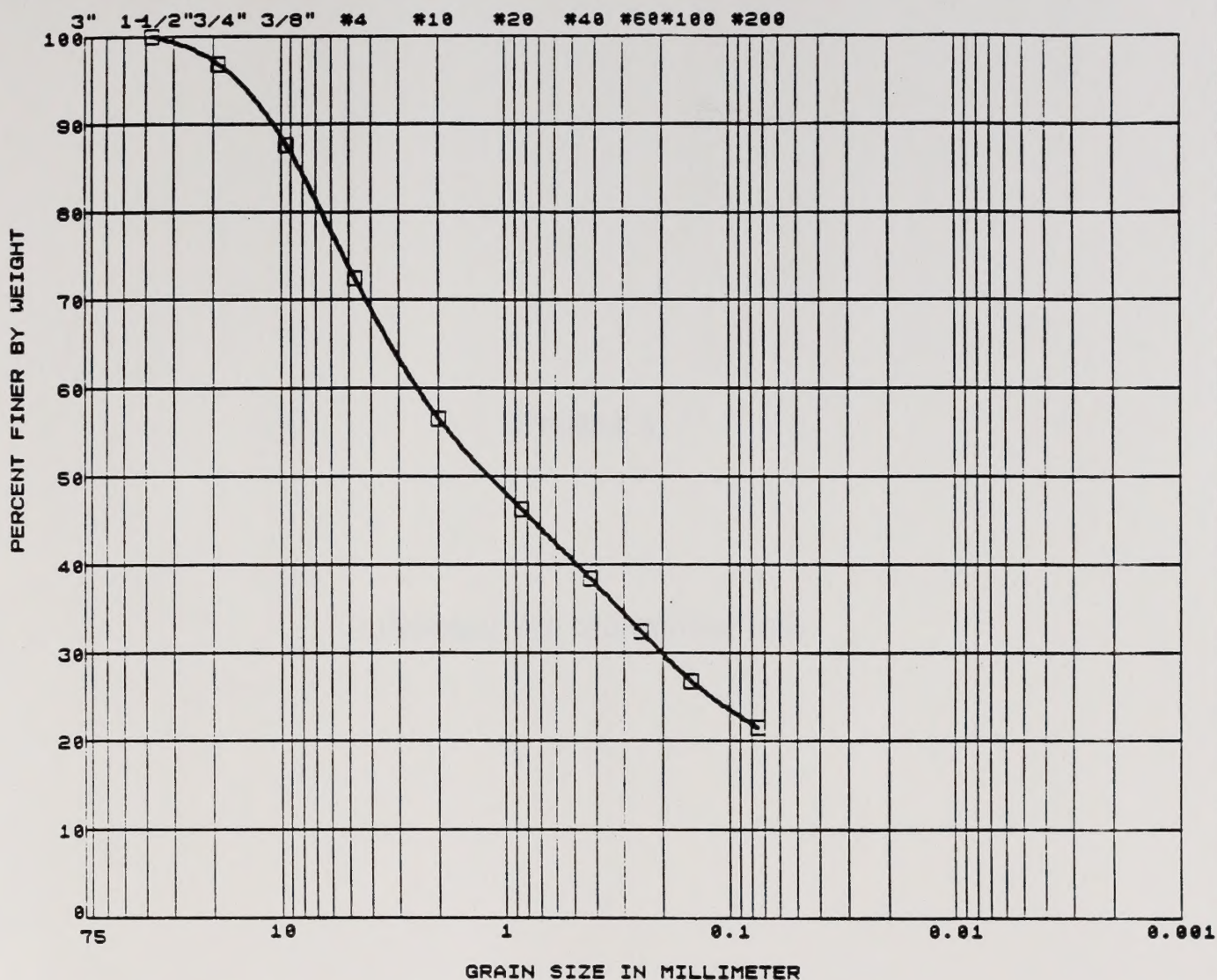
SUMMARY OF LABORATORY TEST RESULTS

Sample ID	Soil Identifi- cation ASTM D 2488 (Group Symbol)	Moisture Content ASTM D 2216 (%)	Dry Density ASTM D 2937 (pcf)	Grain Size Analysis ASTM D 422 GR:SA:FI' (%)
OW1-1-712-712.5	SM	8.3	128.6	28:50:22

GR:SA:FI' = Gravel:Sand:Fines

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

U.S. STANDARD SIEVE OPENING U.S. STANDARD SIEVE NUMBER HYDROMETER



SYMBOL	SAMPLE ID.	DEPTH (FT)	SOIL TYPE	LIQUID LIMIT	PLASTICITY INDEX
□	OW-1-712-712.5	712-712.5	SM		

The Earth Technology Corporation

PROJECT NO: 945.86
PROJECT NAME:
RMC

GRAIN SIZE DISTRIBUTION CURVE

ASTM D422

5/94

FIGURE





HARGIS + ASSOCIATES, INC.

APPENDIX B

LITHOLOGIC AND GEOPHYSICAL LOGS



APPENDIX B

LITHOLOGIC AND GEOPHYSICAL LOGS

TABLE OF CONTENTS

TABLES

Table

B-1	LITHOLOGIC LOG FOR OBSERVATION WELL OW-1
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ILLUSTRATIONS

Figure

B-1	GEOPHYSICAL LOG FOR OBSERVATION WELL OW-1
-----	---



TABLE B-1
LITHOLOGIC LOG FOR OBSERVATION WELL OW-1

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL(a)	DESCRIPTION OF MATERIAL
0 - 90	GRAVELLY SAND	SW	Olive gray (2.5Y 5/2) to yellowish brown (2.5Y 5/4), fine- to coarse-grained, poorly sorted, subrounded to angular; gravel is 0.5 to greater than 1 inch, angular with fresh faces.
90 - 160	SILTY SAND WITH GRAVEL	SM	Strong brown (7.5Y 4/6) to yellowish brown (2.5Y 6/4), fine- to coarse-grained, poorly sorted, subrounded to angular; silt is very soft, nonplastic; gravel is 0.25- to 1-inch, subrounded to angular.
160 - 200	SANDY SILT	ML	Yellowish brown (10YR 5/4), soft to moderately firm, slightly plastic; sand is fine- to coarse-grained, poorly sorted, subrounded to angular.
200 - 225	SILTY SAND/ SANDY SILT	SM/ML	Yellowish brown (10YR 5/4), fine- to medium-grained, predominately fine, moderately sorted, subangular to subrounded; silt is gray (2.5Y 7/2), soft, slightly plastic. From 200 to 205 feet: sandy. From 220 to 225 feet: sandy.
225 - 275	SAND	SW	Yellowish brown (10YR 5/4), medium- to coarse-grained predominantly coarse, moderately sorted, subangular to angular; silt is soft, slightly plastic.
275 - 300	SAND WITH SILT	SW/SM	Yellowish brown (10YR 6/4), medium- to coarse-grained, predominantly coarse, moderately sorted, subrounded to angular; silt is soft, slightly plastic.

(a) Unified Soil Classification System
ASTM D-2488-84



TABLE B-1 (continued)
LITHOLOGIC LOG FOR OBSERVATION WELL OW-1
Page 2 of 3

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL(a)	DESCRIPTION OF MATERIAL
300 - 420	GRAVELLY SILTY SAND	SM	Yellowish brown (10YR 6/4), medium- to coarse-grained, predominantly coarse, moderately sorted, subrounded to angular; silt is soft, slightly plastic; gravel is 0.25-inch, angular with fresh faces.
420 - 454	SILTY SAND	SM	Yellowish brown (10YR 6/4), medium- to coarse-grained, predominantly coarse, moderately sorted, subrounded to angular, fine- to coarse-grained, poorly to moderately sorted, angular; silt is soft, nonplastic; trace gravel.
454 - 534	SILTY GRAVELLY SAND	SM	Yellowish brown (10YR 6/4), medium- to coarse-grained, predominantly coarse, subangular to angular; gravel is 0.25-inch, angular with fresh faces; silt is soft, slightly plastic.
534 - 600	SILTY SAND	SM	Yellowish brown (10YR 6/4), medium- to coarse-grained, predominantly coarse, subangular to angular; trace gravel. From 557 to 586 feet: gravelly.
600 - 658	SANDY SILT	ML	Yellowish brown (10YR 5/4), soft, slightly plastic; sand is fine- to coarse-grained, moderately sorted, subrounded to angular. From 611 to 617 feet: silty sand. From 632 to 641 feet: silty sand.
658 - 697	SILTY GRAVELLY SAND	SM	Yellowish brown (10YR 5/4), fine- to coarse-grained, predominantly coarse, moderately sorted, subangular to angular; gravel is 0.25-inch, angular; silt is soft, slightly plastic.

(a) Unified Soil Classification System
ASTM D-2488-84



TABLE B-1 (continued)
LITHOLOGIC LOG FOR OBSERVATION WELL OW-1
Page 3 of 3

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL (a)	DESCRIPTION OF MATERIAL
697 - 805	SILTY SAND WITH GRAVEL	SM	Yellowish brown (10YR 5/4), fine- to coarse-grained, predominantly coarse, moderately sorted, subangular to angular; silt is soft, slightly plastic; gravel is 0.25- to 1-inch angular, with fresh faces. From 739 to 757 feet: increasing gravel. From 794 to 800 feet: decreasing silt.
805 - 856	SILTY SANDY GRAVEL	GM	Yellowish brown (10YR 5/4), 0.25- to 1-inch, angular with fresh faces; sand is fine- to coarse-grained, moderately sorted, subangular; silt is soft to slightly firm, slightly plastic.
856 - 1,007	SILTY GRAVELLY SAND	SM	Yellowish brown (10YR 5/4), to brown (10YR 4/3), medium- to coarse-grained, predominantly coarse, moderately well-sorted, subangular to angular; gravel is 0.25- to 0.75-inch, angular with fresh faces; silt is soft to slightly firm. From 866 to 874 feet: increasing silt. From 968 to 985 feet: sandy gravel.

TOTAL DEPTH OF BOREHOLE = 1,007 FEET

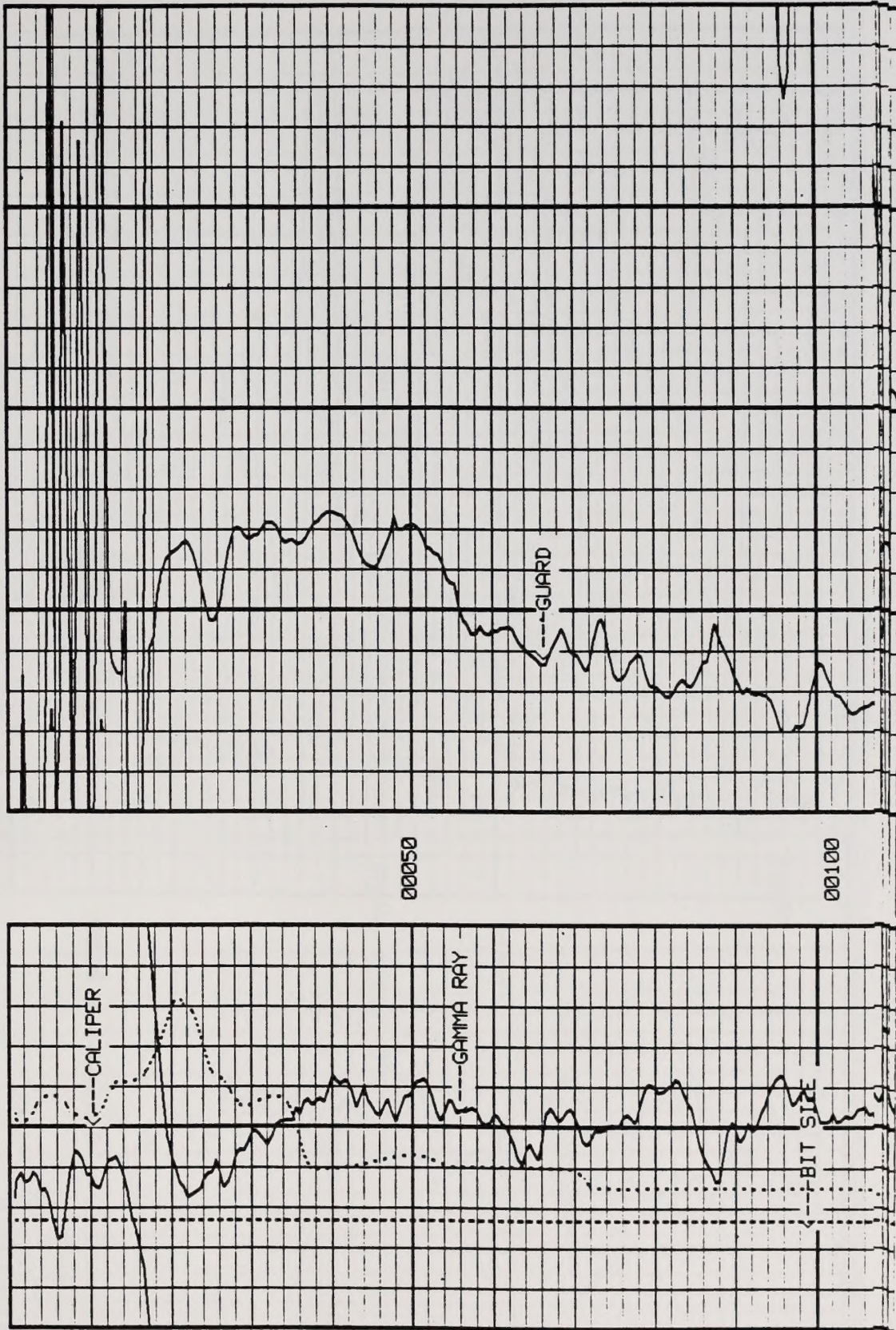


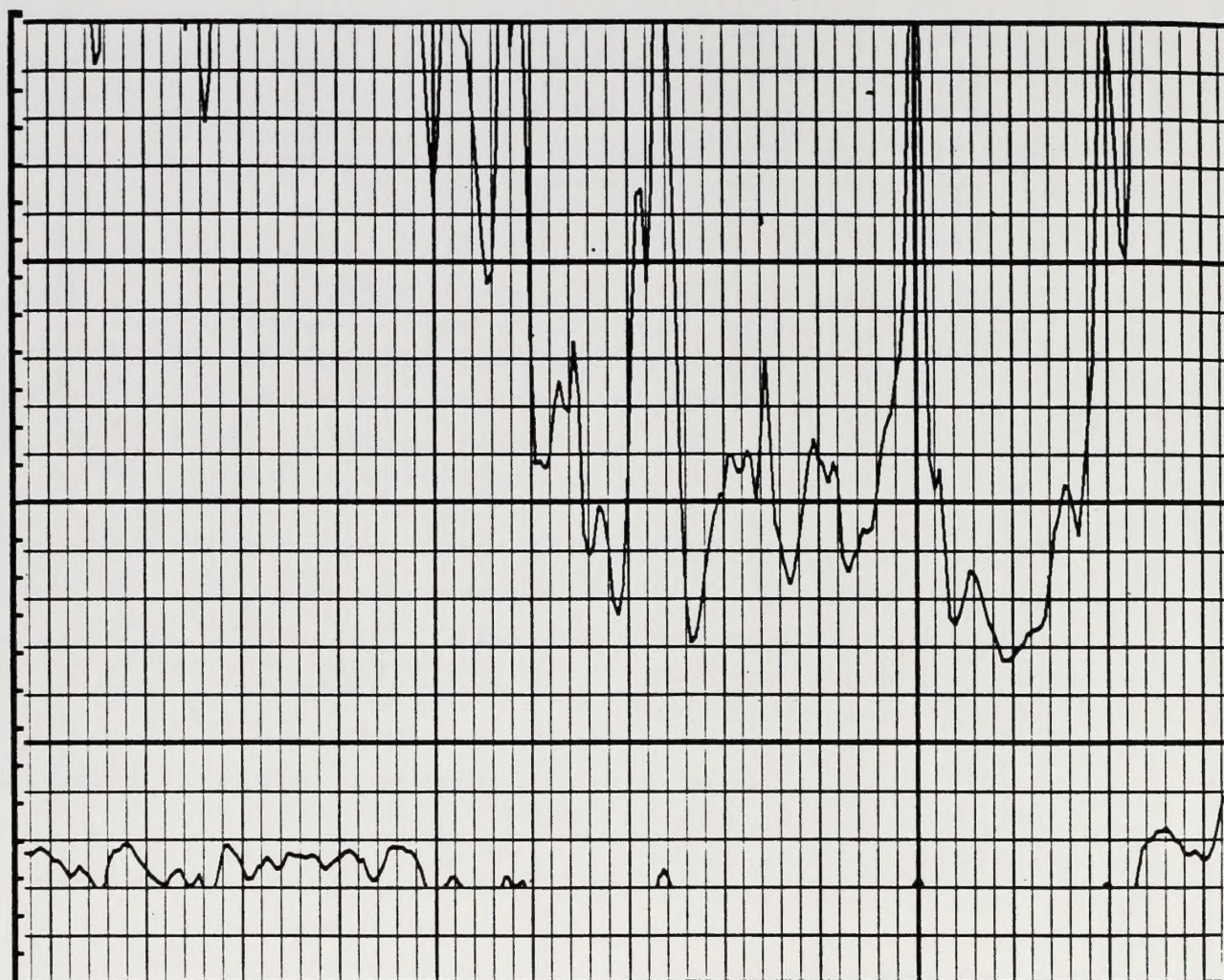
GAMMA RAY-GUARD-CALIPER LOG

FILING NO.	COMPANY	HARGIS & ASSOCIATES		
	WELL	OW-1		
	FIELD	GOLAR HEIGHTS/FREEMONT VALLEY		
	COUNTY	KERN	STATE CALIFORNIA	
JOB NO.	LOCATION: 150' SW OF RMC-4			OTHER SERV:
				NONE
22917	SEC 12	TWP 29S	RGE 39E	
Permanent Datum: G.L.				Elev: N/A
Log Measured From G.L.				0 Ft Above Perm Datum
Drilling Measured From G.L.				
Date	05-09-94	05-09-94		
Run No.	ONE GR-GD	ONE CALIPER		
Depth - Driller	1007'	1007'		
Depth - Logger	1005'	1005'		
Btm. Log Inter.	1004'	1004'		
Top Log Inter.	0'	0'		
Casing-Driller	NONE at	NONE at	at	
Casing-Logger	NONE	NONE		
Bit Size	8.75"	8.75"		
Type Fluid In Hole	BENTONITE	BENTONITE		
Dens.	Visc.	N/A	N/A	N/A
pH	Fluid Loss	N/A	N/A ml	N/A ml
Source of Sample	CIRCULATED	CIRCULATED		
Rm at Meas.Temp	7.8 at 75 F	7.8 at 75 F	at F	
Rmf at Meas.Temp	7.7 at 75 F	7.7 at 75 F	at F	
Rmc at Meas.Temp	N/A at N/AF	N/A at N/AF	at F	
Source:Rmf Rmc	MEAS. N/A	MEAS N/A		
Rm at BHT	N/A at N/AF	N/A at N/AF	at F	
Time Since Circ.	0 HR.	0 HR.		
Max. Rec. Temp.	N/A	N/A	F	
Equip	Location	L-23	BFL.	L-23
Recorded By	M. SHARPLESS	M. SHARPLESS		
Witnessed By	K. KISTLER	K. KISTLER		

EQUIPMENT DATA				
LOG TYPE	GR-GUARD		CALIPER	
RUN NO.	ONE		ONE	
TOOL MODEL NO.	MLS-1		MLS-TAC	
TOOL SERIAL NO.	PT-1		T-127	
DIAMETER	2 1/8"		1.25"	
DETECTOR TYPE	SCINT.		12"	
DETECTOR LENGTH	4"		N/A	
UNITS/DIV.	10 API/OHM		1 INCH	
SENSITIVITY	100/250		500/500	
ZERO DIV L OR R			0-L	
SPEED-FPM	25		25	
DATA SAMPLES/FT.	2		2	
FORMATION FACTOR	N/A		N/A	
PUMP RATE-GPM	N/A		N/A	
PUMP RATE-GPM				
PUMP RATE-GPM				
SOURCE TYPE	STRENGTH	SPACING	MODEL NO	SERIAL NO.
N/A	N/A	N/A	N/A	N/A
PERFORATIONS: NONE--OPEN HOLE				
REMARKS:				
NOTICE: All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by one of our officers, agents or employees. These interpretations are also subject to our General Terms and Conditions as set out in our current Price Schedule. WELENCO, INC.				

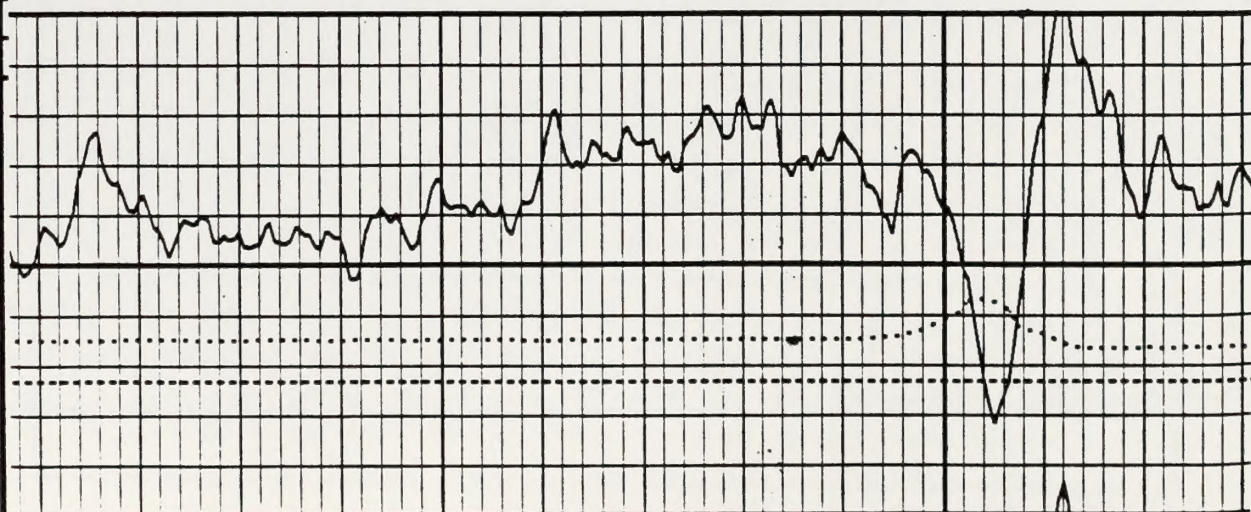
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6....	CALIPER Diameter In Inches.....16			0	GUARD RESISTIVITY X10 BACK UP	1000

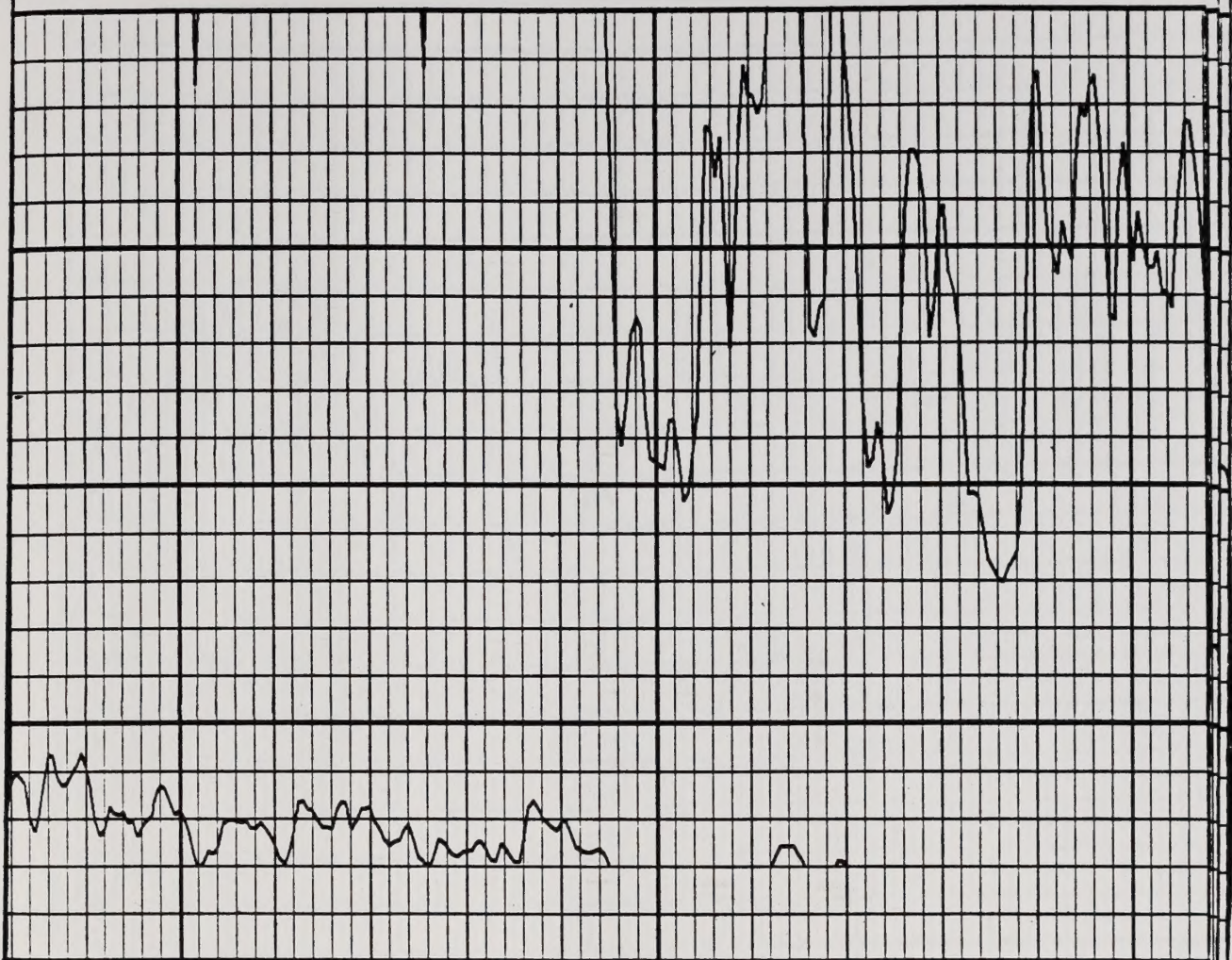




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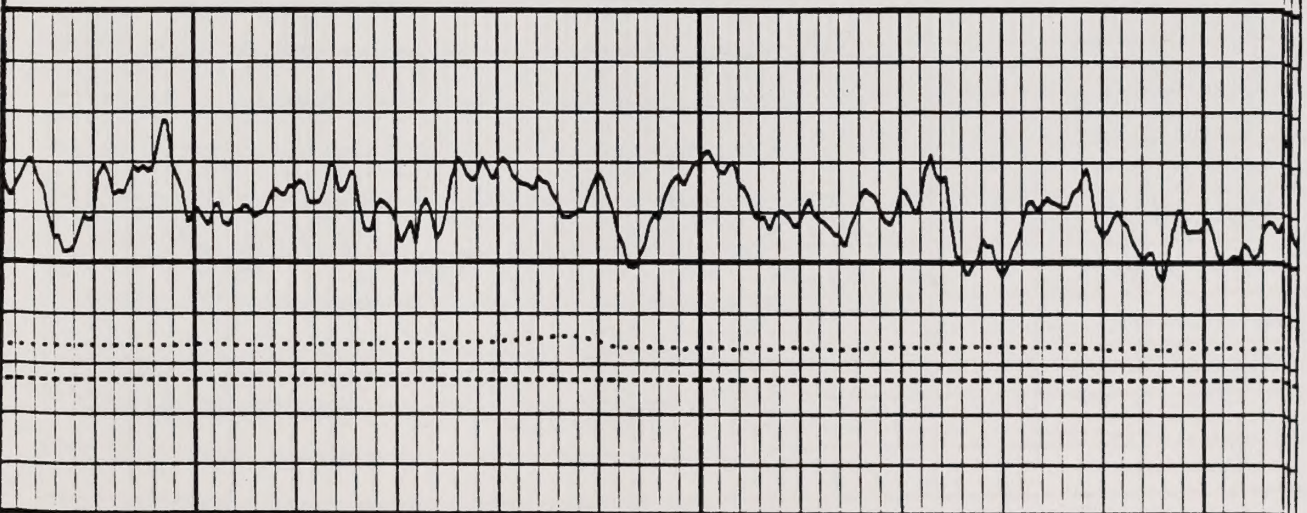


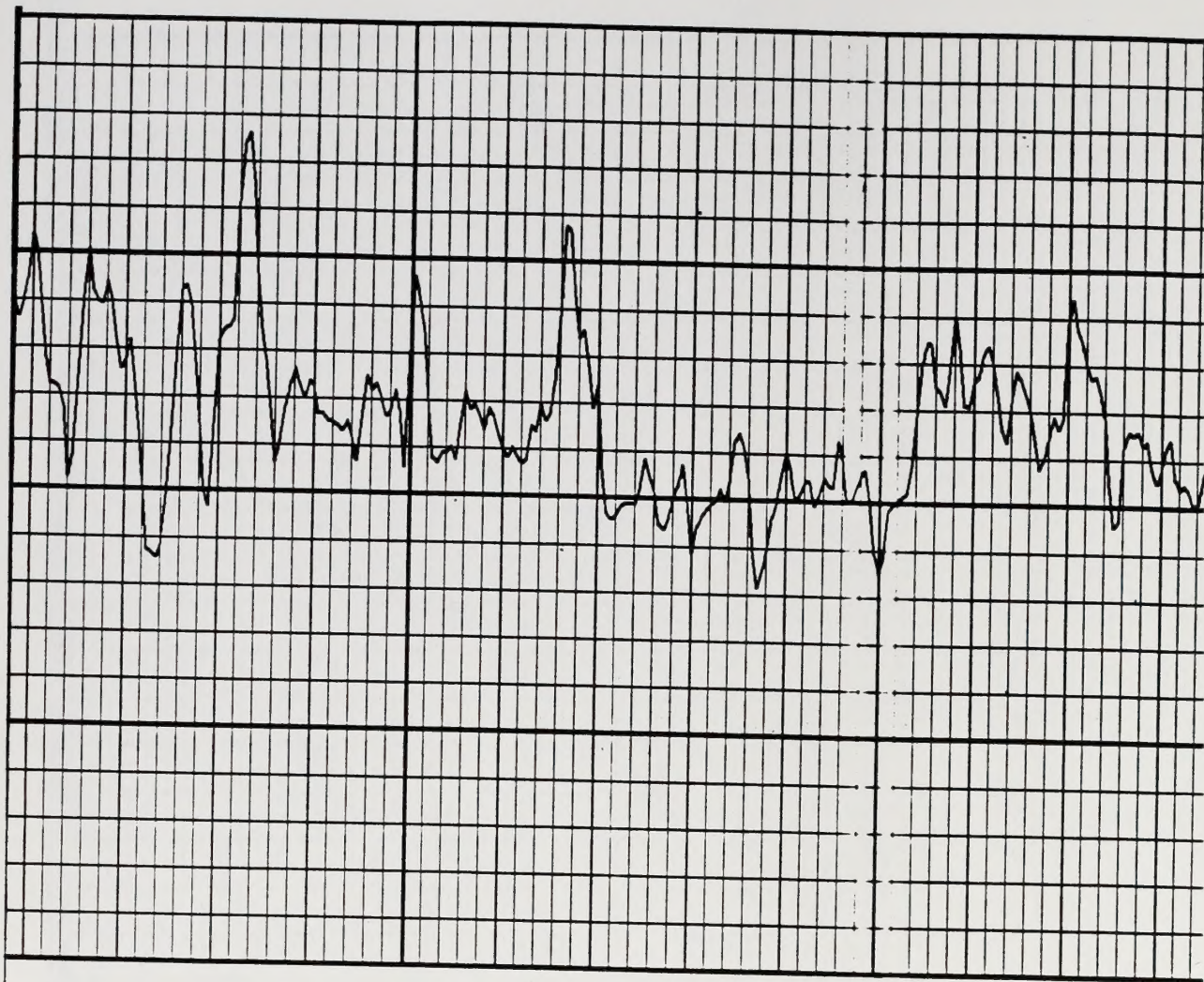


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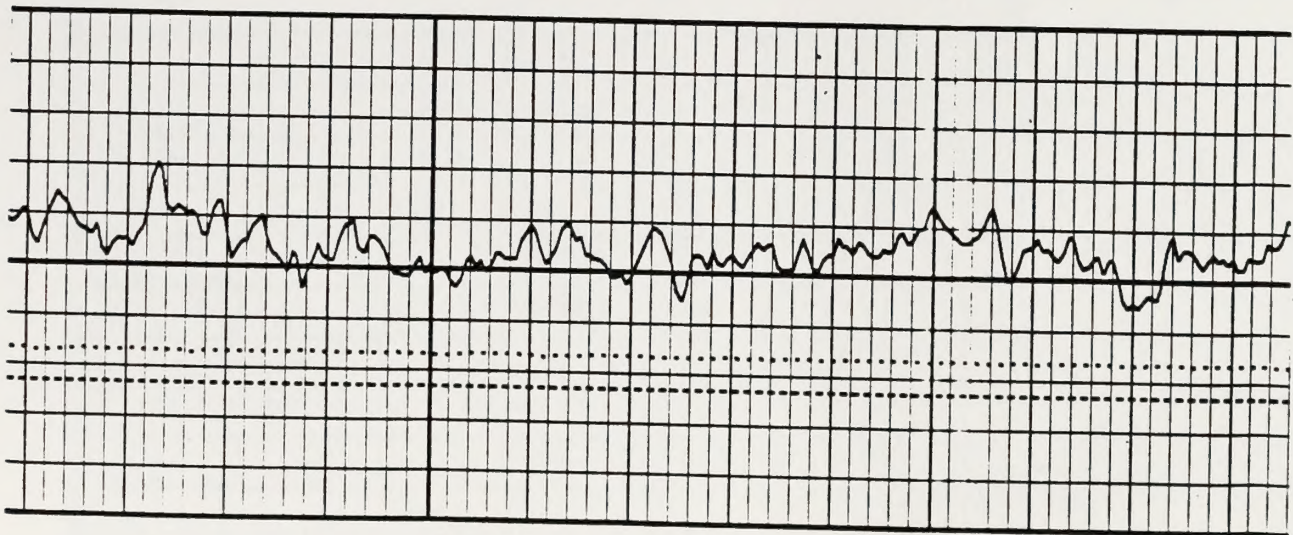
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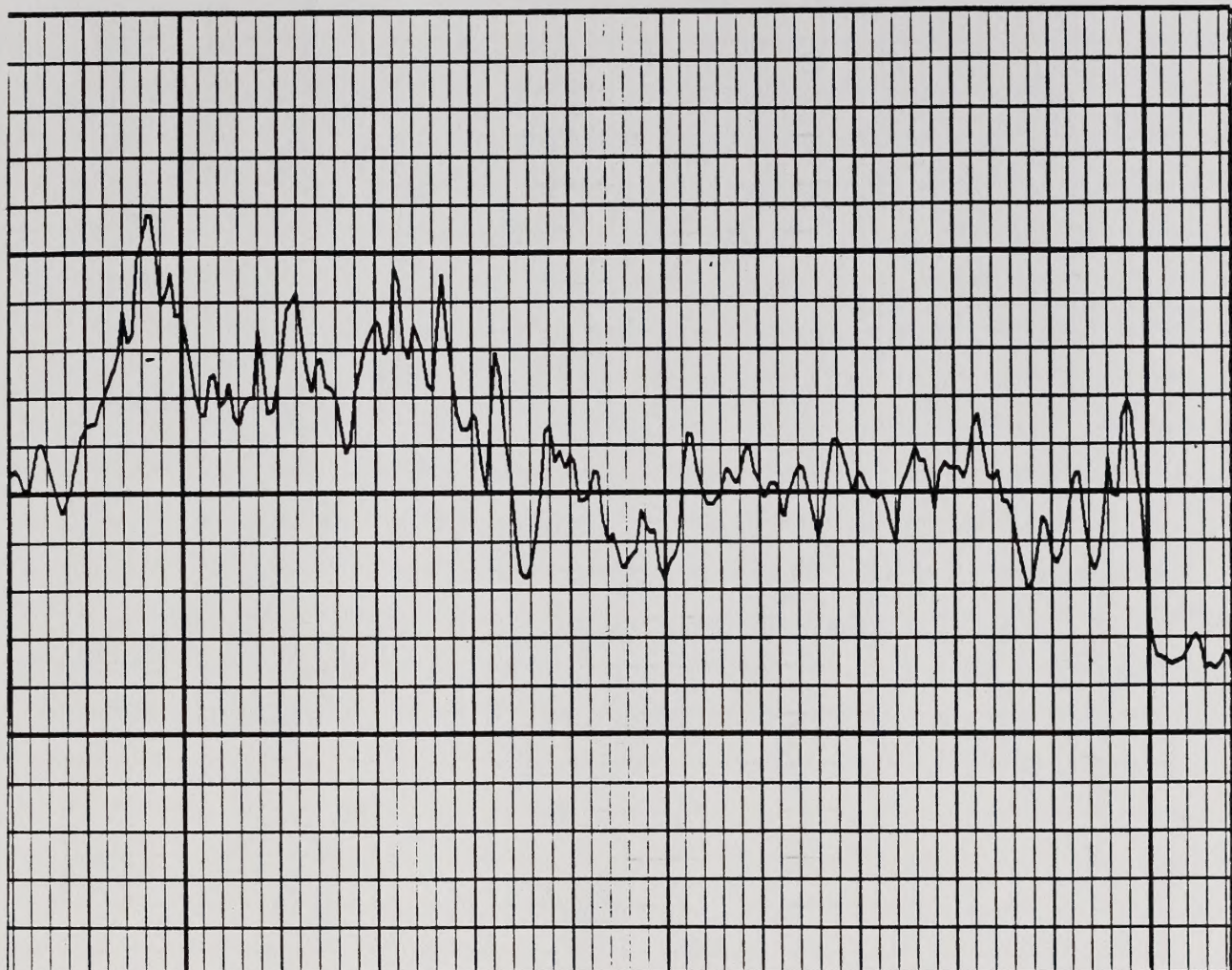




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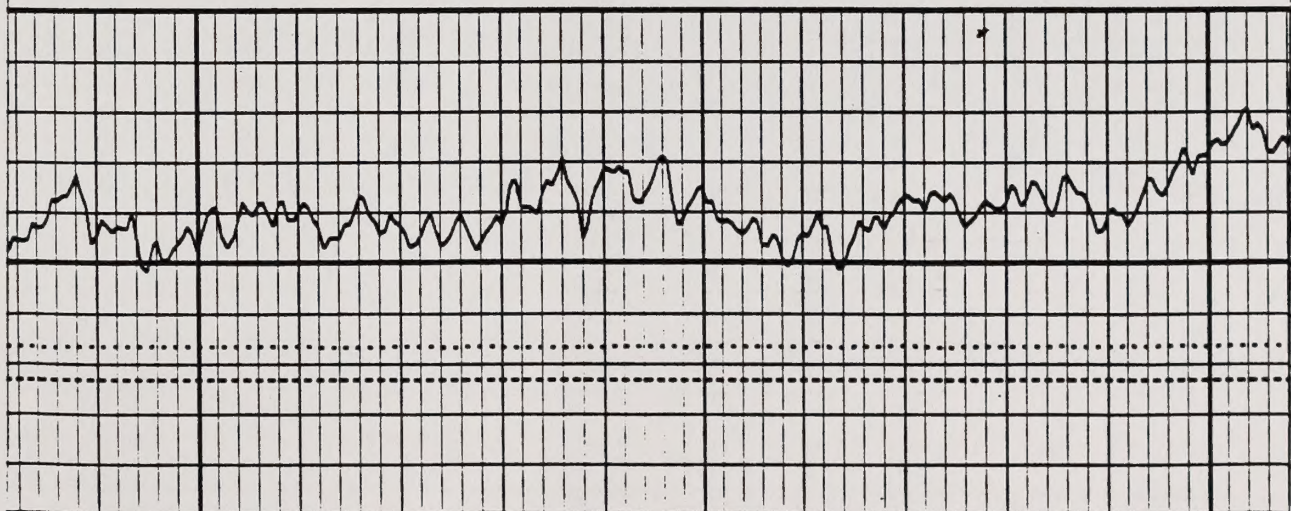


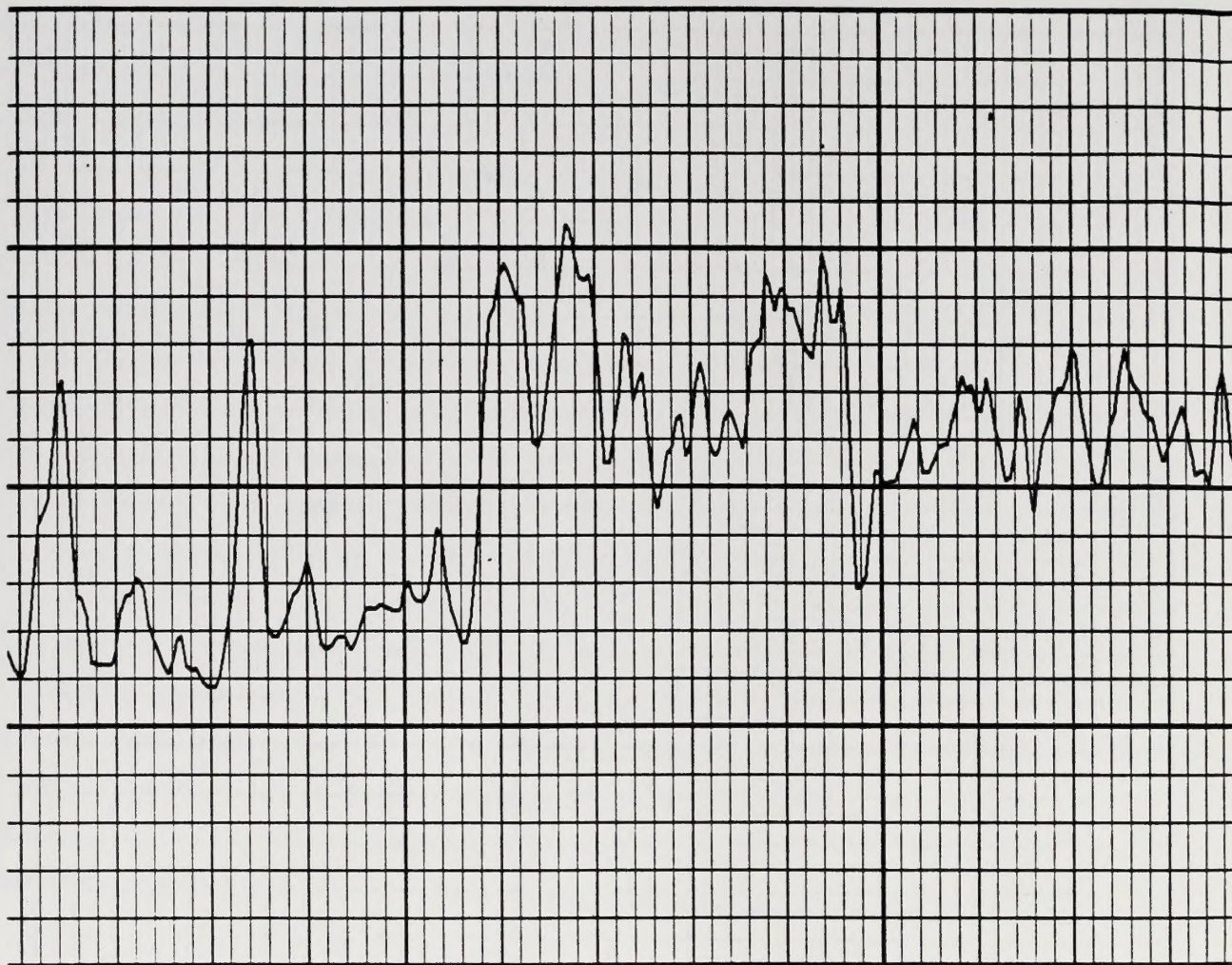


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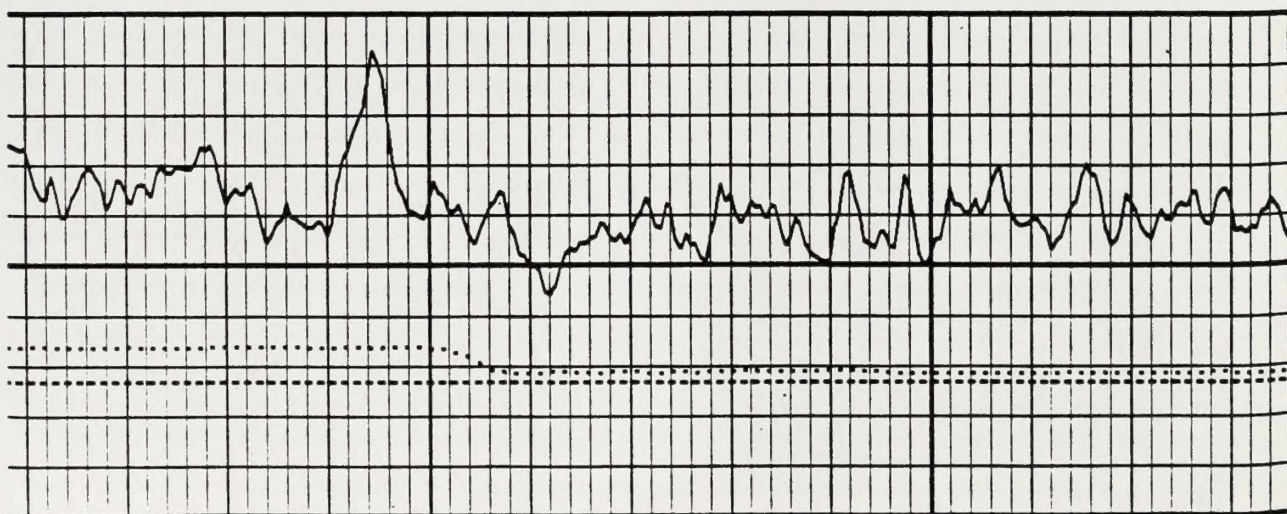
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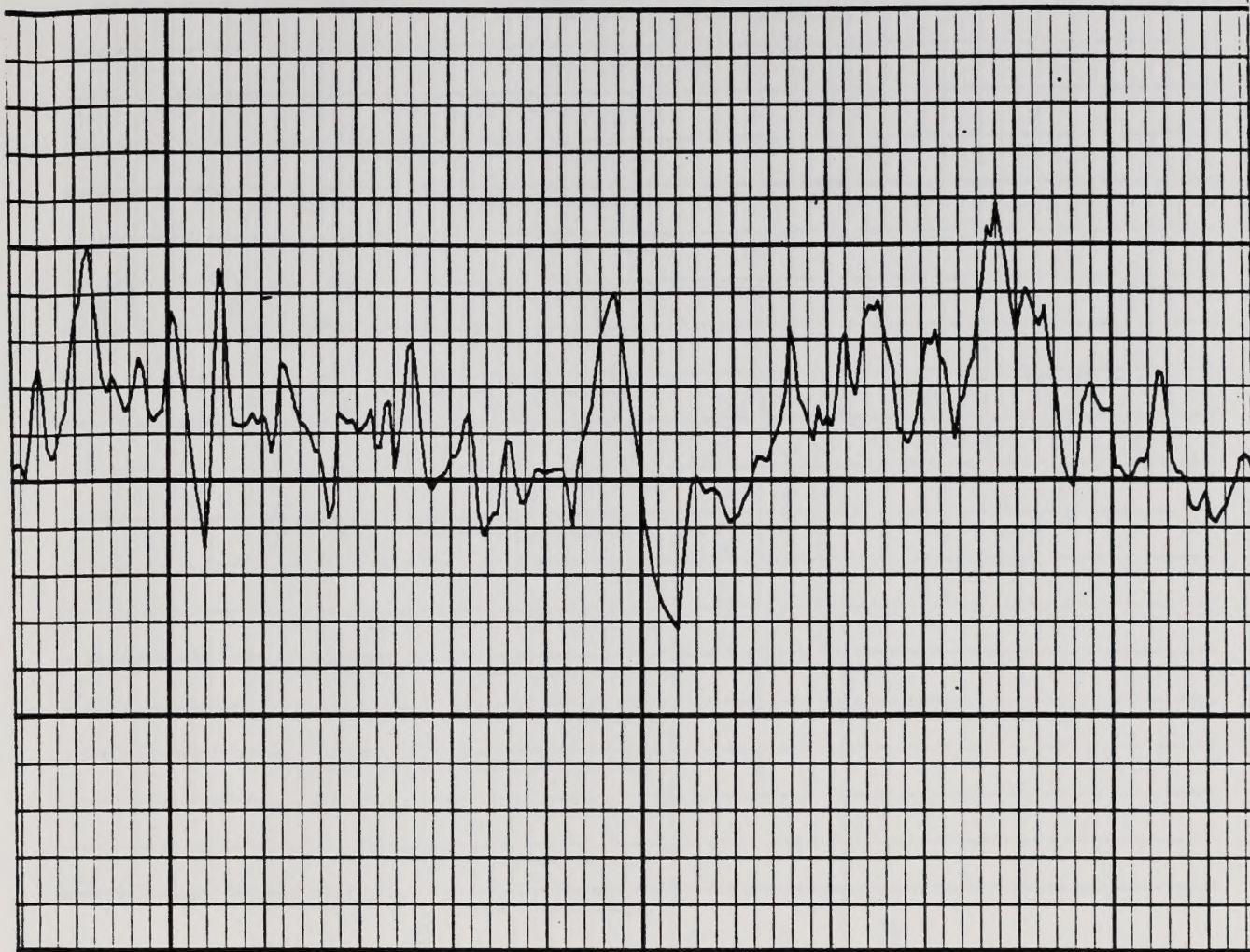




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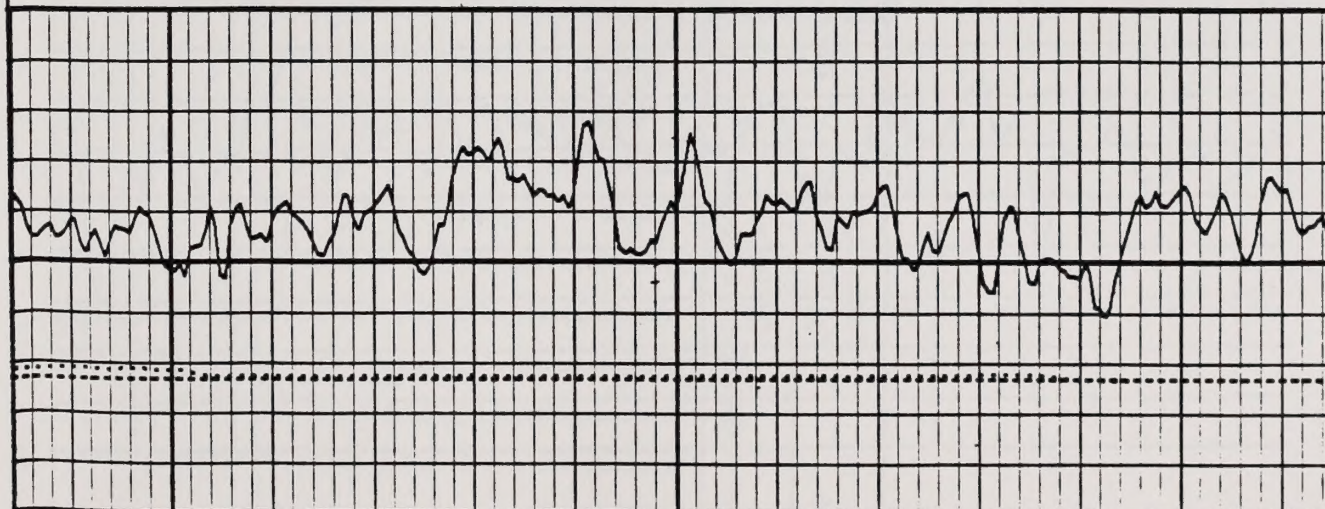


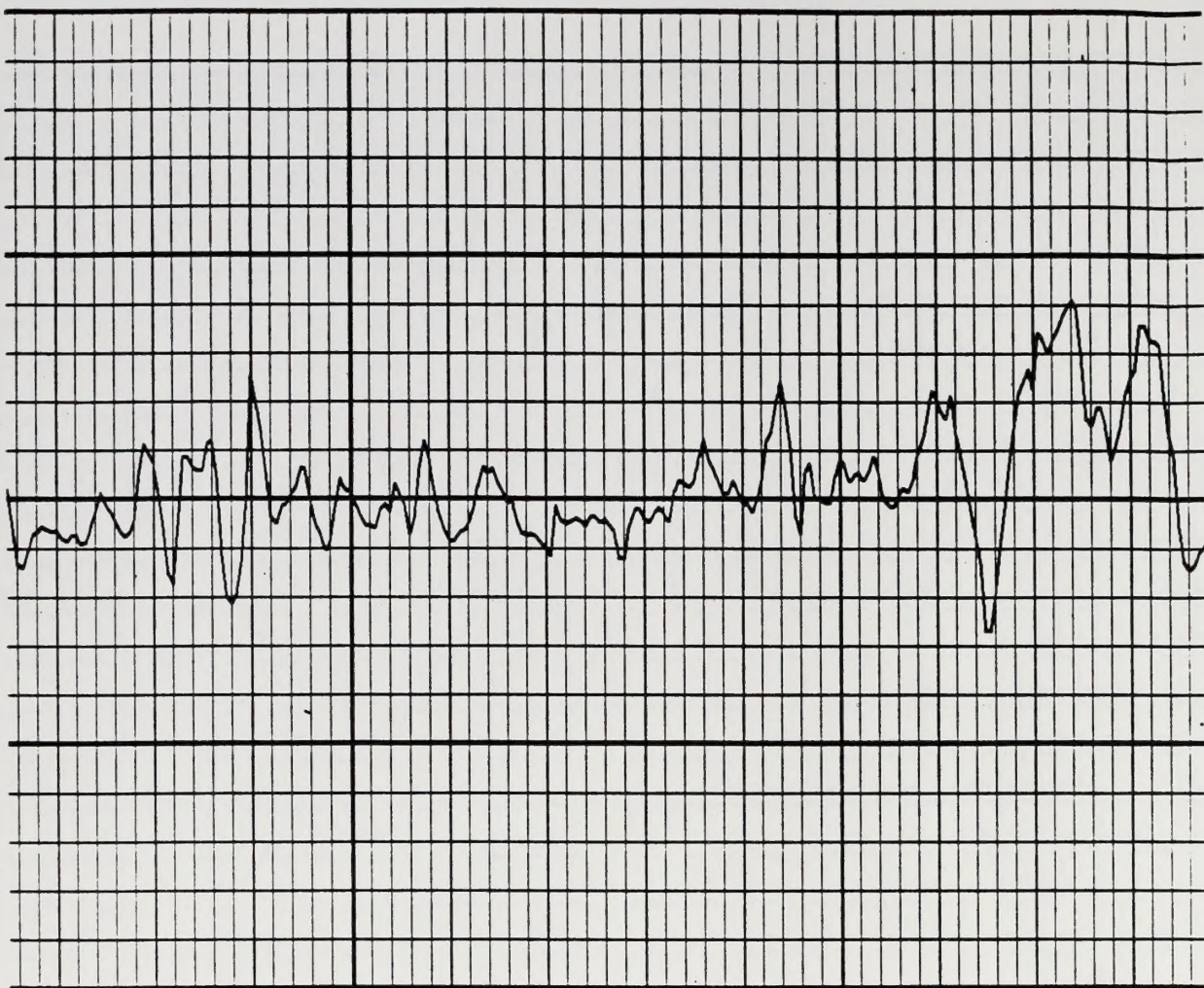


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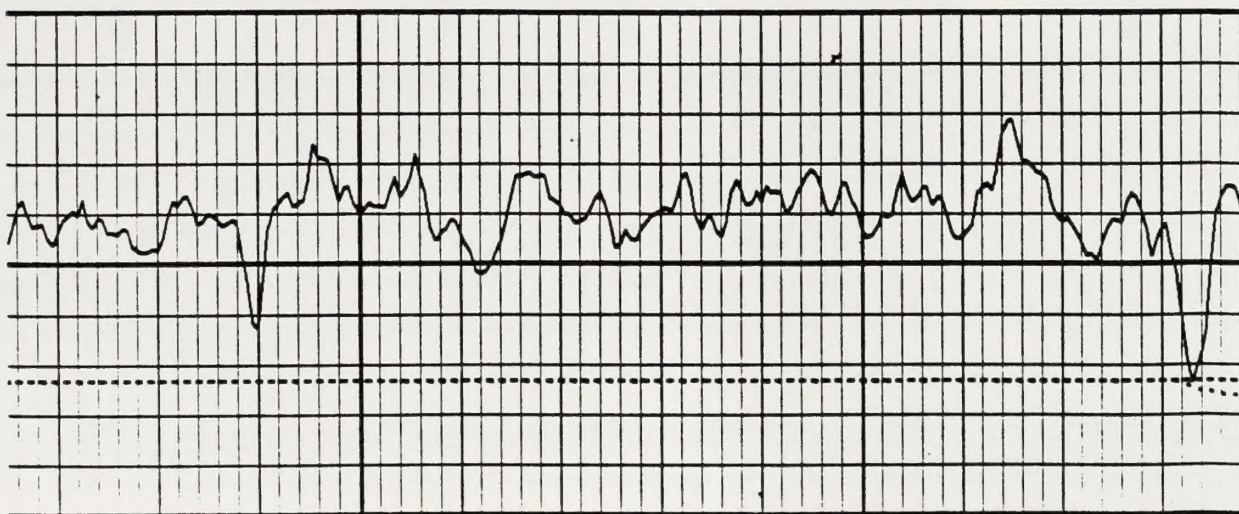
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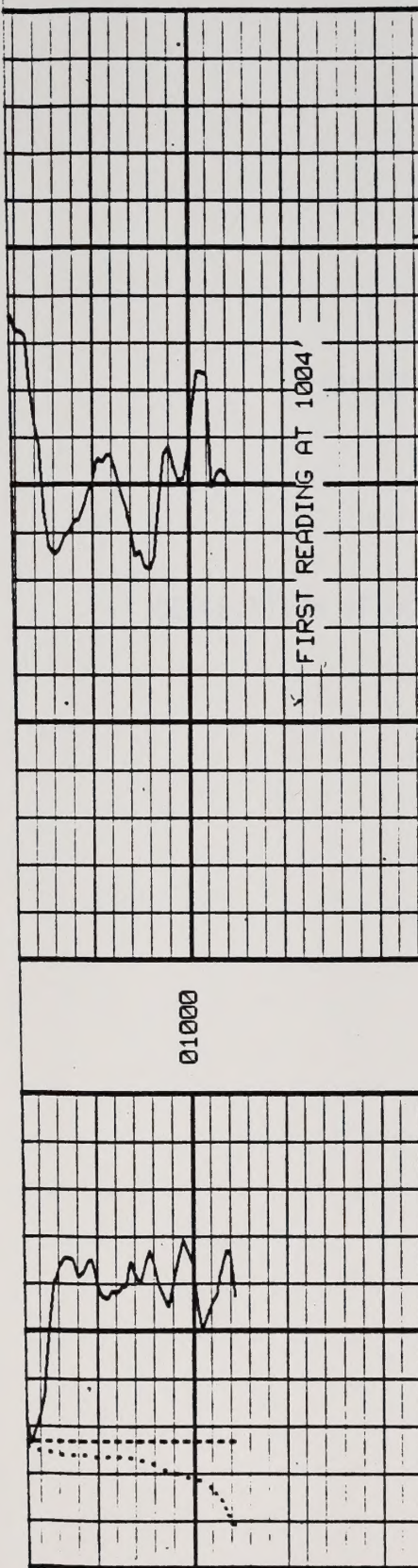




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6...Diameter In Inches.....16 CALIPER		0	X10 BACK UP GUARD RESISTIVITY	1000
0 API Units GAMMA RAY	100	0	Ohmmeters GUARD RESISTIVITY	100
	DEPTHS			



APPENDIX D

DESCRIPTION OF NUMERICAL MODELS



APPENDIX D

DESCRIPTION OF NUMERICAL MODELS

TABLE OF CONTENTS

Section	Page
1.0 GROUNDWATER FLOW MODEL	D-1
1.1 MODEL GRID	D-1
1.2 BOUNDARY CONDITIONS	D-1
1.3 GROUNDWATER PUMPAGE AND RECHARGE	D-2
1.4 HYDRAULIC CONDUCTIVITY AND STORATIVITY	D-4
1.5 MODEL SIMULATIONS	D-5
1.6 SENSITIVITY ANALYSIS	D-6
2.0 PARTICLE TRACKING MODEL	D-8
2.1 MODEL CONFIGURATION	D-8
2.2 MODEL SIMULATIONS	D-8
3.0 REFERENCES CITED	D-10

TABLES

Table	
D-1	PUMPAGE INCLUDED IN MODFLOW MODEL SIMULATIONS
D-2	MODFLOW MODEL SIMULATION SUMMARY
D-3	VARIATION OF HYDRAULIC PARAMETERS FOR SENSITIVITY ANALYSIS
D-4	SENSITIVITY ANALYSIS RESULTS



TABLE OF CONTENTS (continued)

ILLUSTRATIONS

Figure

D-1	GROUNDWATER FLOW MODEL CONFIGURATION
D-2	DRAWDOWN AFTER 6 YEARS (CASE 1)
D-3	DRAWDOWN AFTER 12 YEARS (CASE 1)
D-4	DRAWDOWN AFTER 16 YEARS (CASE 1)
D-5	DRAWDOWN AFTER 6 YEARS (CASE 2)
D-6	DRAWDOWN AFTER 12 YEARS (CASE 2)
D-7	DRAWDOWN AFTER 16 YEARS (CASE 2)
D-8	DRAWDOWN AFTER 6 YEARS (CASE 3)
D-9	DRAWDOWN AFTER 12 YEARS (CASE 3)
D-10	DRAWDOWN AFTER 16 YEARS (CASE 3)
D-11	DRAWDOWN AFTER 6 YEARS (CASE 4)
D-12	DRAWDOWN AFTER 12 YEARS (CASE 4)
D-13	DRAWDOWN AFTER 16 YEARS (CASE 4)
D-14	PARTICLE PATH LINES AFTER 16 YEARS



APPENDIX D DESCRIPTION OF NUMERICAL MODELS

1.0 GROUNDWATER FLOW MODEL

The MODFLOW groundwater flow model code was used to simulate the effects of pumpage on groundwater levels in northern Fremont Valley, California. The MODFLOW code was developed by the U.S. Geological Survey (McDonald, M.G. and A.W. Harbaugh, 1988) and is one of the most widely used and accepted groundwater flow models available. To determine the sensitivity of the model results to variations in the model parameters, a sensitivity analysis was performed by varying hydraulic conductivity and storativity of the aquifer. The following sections describe the MODFLOW code and its application to this particular hydrogeological analysis.

1.1 MODEL GRID

Setting up a numerical groundwater flow model such as MODFLOW involves establishing a model grid that covers the study area. A numerical model solves groundwater flow equations sequentially within each model grid cell. For the purposes of this hydrogeological analysis, a model grid was defined that covered the Fremont Valley area northeast of Koehn Lake (Figure D-1). The model grid consisted of 112 rows and 126 columns with a uniform 500-foot grid spacing. The total area simulated in the MODFLOW model grid was approximately 127 square miles. The grid consisted of a single layer of cells. The aquifer thickness was assumed to be 500 feet over the entire model grid based on the known average saturated thickness of the aquifer in the basin.

1.2 BOUNDARY CONDITIONS

Boundary conditions are defined around the perimeter of the model grid to simulate groundwater flow into or out of the model, or to simulate areas of



relatively impermeable materials. For this hydrogeological analysis, no-flow boundaries were established along the mountain fronts around the margin of northern Fremont Valley. These no-flow boundaries represent the approximate location where the alluvial sediments in the valley contact the underlying bedrock of the mountains. The low permeability bedrock is not believed to contribute significant quantities of groundwater to the alluvial aquifer in northern Fremont Valley, and is therefore considered a no-flow boundary in the model.

A general head boundary was used to simulate groundwater flow into or out of the western boundary of the model. This boundary condition was defined along the western edge of the model grid where it crosses the valley. The general head boundary condition allows simulation of groundwater flow across a model boundary in response to the gradient between the edge of the model and a point at some distance away. The model grid area extends to the edge of Koehn Lake. During recent years, surface water in Koehn Lake has been at a location approximately 17,000 feet southwest of the model grid area. For this model, it was assumed that a constant head boundary condition would be associated with the surface water in Koehn lake. The hydraulic conductivity in the 17,000-foot area between the model grid boundary and the edge of the surface water was assumed to be the same as that used in the southwestern portion of the model.

The aquifer thickness over the entire modeled area was assumed to be 500 feet. The MODFLOW code does not allow groundwater flow across the bottom boundary of the model.

1.3 GROUNDWATER PUMPAGE AND RECHARGE

The model simulated pumpage from a total of 13 wells and was based on current or projected pumping estimates (Section 2.3; Table D-1). The pumpage from Rand Mining Company (RMC) production well RMC-4 was varied yearly throughout the simulation based on the projected average rates (RMC, 1994). Model simulations were performed for a 16-year period beginning in 1995.



Pumpage from the Consolidated Placer Dredging (CPD) production wells CPD-1, CPD-2, and CPD-4 was also varied over the model simulation time to account for the delayed arrival of recharge from the surface holding ponds to the groundwater table. Based on a 550-foot thickness of unsaturated sediments, a vertical hydraulic conductivity of 0.75 gallons per day per square foot (gpd/ft²), an effective sediment porosity of 20 percent, aquifer recharge in this area was estimated to begin 3 years after CPD operations begin in 1994. Thus, groundwater pumpage from each of the three CPD wells was assumed to be 50 gallons per minute (gpm) for the first 2 years of the model. It was assumed that, after 2 years of the model simulation, recharge from the ponds would begin to reach the aquifer and the pumpage from each well was decreased to 12 gpm for Years 3 through 5 of the model to account for this recharge. Pumpage from the CPD production wells is expected to cease after 1999, the fifth year of the simulation period.

Pumpage from the agricultural and Rand Communities Water District (RCWD) wells was assumed to be steady throughout the simulation period. The current agricultural pumpage of 8,000 acre feet per year (AF/yr) was equally distributed among six irrigation wells in the southwestern portion of the model grid. To account for recharge due to irrigation return flows, the pumpage in the model for these wells was reduced by 16 percent from the reported total pumpage. Pumpage from RCWD production wells RCWD-1 and RCWD-2 was based on the current total production of 65 AF/yr. This pumpage was distributed equally between each well and assumed to be steady throughout the simulation period.

Natural recharge to the groundwater in the study area is assumed to occur in areas where major canyons enter the basin. The total quantity of natural recharge is estimated to be 50 AF/yr (Section 2.3). For the model simulations, this amount of recharge was spread equally among the five areas where large drainages enter the basin. A total of 25 model cells were assigned as recharge cells, 5 cells associated with each stream location. The recharge was divided equally among all cells.

Artificial recharge occurs in the study area through infiltration of irrigation water. Because the irrigated fields are located in the same general



areas as the irrigation wells, this recharge was simulated by simply reducing the total pumpage to reflect the net loss of water from the system. As previously stated, the total pumpage from the six wells in the southwest portion of the model was decreased by a factor of 16 percent to account for the irrigation return flows.

Artificial recharge will also occur in the vicinity of the CPD mining operations. To account for this recharge, the pumpage from the three CPD production wells was reduced during the third through the fifth year of the simulations. Since CPD mining operations cease after 5 years, the CPD wells become recharge cells during the sixth and seventh years of the simulations, recharging water at a rate of 38 gpm.

1.4 HYDRAULIC CONDUCTIVITY AND STORATIVITY

Four zones of hydraulic conductivity were used in the model (Figure D-2). The lowest hydraulic conductivity of 7.5 gpd/ft^2 was defined in the northeastern portion of the model grid where production wells RMC-2 and RMC-3 and the CPD production wells are located. An intermediate hydraulic conductivity value of 150 gpd/ft^2 was defined in the central portion of the model grid surrounding the RCWD production wells. Hydraulic conductivity in the southwestern portion of the model grid surrounding the agricultural wells was defined as 300 gpd/ft^2 . A narrow strip of the model grid between the Garlock and the El Paso Mountain faults was assigned a hydraulic conductivity of 75 gpd/ft^2 . Production well RMC-4 is located in this area.

Estimates of hydraulic conductivity were derived from aquifer test results, evaluation of well specific capacity and production rates, and the estimated saturated thickness of the aquifer (Section 4.3). The hydraulic conductivity of the area north of the Garlock Fault is based on, but slightly greater than, the hydraulic conductivity value of 65 gpd/ft^2 determined from the aquifer test results. A hydraulic conductivity of 75 gpd/ft^2 was used in this portion of the model as an approximate value. This value of hydraulic conductivity is 10 times



greater than the value assigned in the vicinity of the CPD wells and two times less than the value assigned in the vicinity of the RCWD wells.

A uniform storativity value of 0.04 was used in the model. This value is lower than typically reported for unconfined aquifers (Driscoll, 1986).

1.5 MODEL SIMULATIONS

A series of four model simulations were performed to assess the effects of the proposed increase in pumpage from production well RMC-4 on projected groundwater levels in the basin. Two simulations were performed with production well RMC-4 pumping alone, one with the additional pumpage of the Rand Project and one without. Two additional simulations were performed with production well RMC-4 and all other wells pumping, again with and without the pumpage associated with the Rand Project. The model simulation parameters have been summarized (Table D-2). Each simulation was run for a 16-year pumping period, and projected drawdowns were plotted at the 6-, 12-, and 16-year time steps (Figures D-2 through D-13). The results of these simulations are described in Section 5.1 of this report.

The MODFLOW model allows variable pumping rates for both production well RMC-4 and regional wells, incorporates basin boundaries and recharge of the aquifer, and allows variation in the aquifer hydraulic parameters across the basin. The simulations performed for this analysis used a conservative approach by estimating drawdowns assuming an initial flat water table condition. This approach is considered conservative because production well RMC-4 is located upgradient of the RCWD wells. Since groundwater flow in northern Fremont Valley is toward the southwest where the RCWD production wells are located, any pumpage of production well RMC-4 would tend to decrease the groundwater gradient in this area but not reverse it. By assuming a flat water table as the initial condition, projected drawdowns caused by pumping production well RMC-4 are greater than if the drawdowns were projected using a sloping water table condition. In addition, historical water level and pumping data were



insufficient to allow for model calibration required to project drawdowns using a sloping water table condition.

It should be noted that drawdowns projected by the model represent the average over each 500-foot grid cell and, thus, the model underestimates the actual drawdown in the immediate vicinity of a pumping well. At distances greater than 500 feet from pumping wells, model projections may be considered representative of actual water level drawdowns.

1.6 SENSITIVITY ANALYSIS

A sensitivity analysis was conducted to assess the sensitivity of the model results to changes in estimates of hydraulic conductivity and storativity. The Case 2 simulation was considered as the base case for the sensitivity analysis. During the sensitivity analysis, hydraulic conductivity and storativity were varied independently within their estimated ranges of variability. A total of four model simulation runs were performed simulating low and high hydraulic conductivity, and low and high storativity (Table D-3). The hydraulic conductivity is not uniform over the model grid. During the sensitivity analysis, all values of hydraulic conductivity in all portions of the model grid were simultaneously increased or decreased by the same factor. Thus, the areas of relatively lower and higher hydraulic conductivity in the model grid were retained in the sensitivity analysis.

Hydraulic conductivity values for the sensitivity analysis were varied by a factor of two based on evaluation of the range in published specific capacity data, pumping capacity data, and previously published estimates. The low and high values of hydraulic conductivity were, respectively, 3.25 and 15 gpd/ft² in the northeastern portion of the basin, 75 and 300 gpd/ft² in the central portion, 150 and 600 gpd/ft² in the southwestern portion, and 32.5 and 150 gpd/ft² in the area north of the Garlock Fault (Figure D-1).



Storativity values for the sensitivity analysis were varied an order-of-magnitude based on the results of field investigations and on evaluation of published values. Storativity for the sensitivity analysis ranged from 0.004 to 0.2. The low value of storativity was determined based on the potential of semiconfined aquifer conditions due to the fine-grained aquifer materials encountered during drilling. A storativity value on the order of 0.001 is typical of semiconfined aquifers (Mercer et al., 1982; Driscoll, 1986). The high value of storativity was based on typical published values for unconfined aquifers (Driscoll, 1986).

The results of the sensitivity analysis have been summarized (Table D-4). The sensitivity of the model projections to changes in hydraulic conductivity and storativity varied depending on the location in the basin and the pumping period of the simulation. In most cases, the minimum drawdown projections were obtained from the high-storativity sensitivity case. The maximum drawdown projections resulted from both the low-hydraulic conductivity and the low-storativity sensitivity cases. This temporal and spatial variability in sensitivity is related to the changes in production well RMC-4 pumpage with time and the fact that hydraulic conductivity is not uniform over the model grid. In general, the results of the sensitivity analysis indicate that the worst-case model-projected drawdowns throughout the basin are no more than 4 feet greater than the Case 2 model projections after 16 years of pumping.



2.0 PARTICLE TRACKING MODEL

The PATH3D particle tracking model code (C. Zheng, 1989) was used to assess the possible effects of the proposed increased pumpage from production well RMC-4 on water quality in the vicinity of the RCWD wells. PATH3D is a general particle tracking program for calculating groundwater flow paths and travel times in steady-state or transient groundwater flow fields. It is configured to run directly with the head arrays generated from MODFLOW model simulations. For the purposes of the hydrogeological analysis, PATH3D was used to assess the possible movement of a contour line representing the 500 milligrams per liter (mg/l) concentration contour of total dissolved solids (TDS) in response to the proposed increased pumpage due to the Rand Project.

2.1 MODEL CONFIGURATION

For this analysis, the PATH3D model was used in conjunction with the MODFLOW model code. The projected heads from the MODFLOW simulations provided the water level input for PATH3D. The same grid spacing and hydraulic conductivity used in the MODFLOW simulations were used by PATH3D. In order to calculate particle velocity, PATH3D requires an effective porosity value, which was estimated to be 20 percent based on the lithologies of the aquifer sediments (Driscoll, 1986).

Within the 500-foot grid cells containing pumping wells, PATH3D uses an analytical solution to determine which particles are actually captured by the pumping well. Captured particles are removed from the simulation, although the pathlines along which the particles traveled to the wells are saved.

2.2 MODEL SIMULATIONS

A PATH3D simulation was performed over three stress periods to account for changes in the groundwater flow field with time. The MODFLOW projected



groundwater levels from the sixth year of the simulation were used for Years 1 through 7 of the PATH3D simulations. The MODFLOW projected groundwater levels from the 12th year of the simulation were used for Years 8 through 13 of the PATH3D simulations. The MODFLOW projected groundwater levels from the 16th year of the simulation were used for Years 14 through 16 of the PATH3D simulations.

One particle was placed in each of the 500-foot grid cells along the 500 mg/l TDS contour. PATH3D then tracked these particles through the changing groundwater flow fields to their final positions (Figure D-14). Preliminary calculations to determine the extent of movement of a particle in flow field with the amount of regional pumpage estimated for the basin indicated that the contour might be expected to only move approximately 500 feet with all wells pumping. Based on these preliminary calculations, only one simulation was completed with production well RMC-4 and all other wells pumping. This simulation was performed using the pumpage associated with the Rand Project pumpage. The results of this model simulation are described in Section 5.2 of this report.



3.0 REFERENCES CITED

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- McDonald, M.G. and A.W. Harbaugh, 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model. U.S. Geological Survey, Washington, D.C.
- Mercer, J.W., S.D. Thomas, and B. Ross, 1982. Parameters and Variables Appearing in Repository Siting Models. Prepared for the Division of Waste Management, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission; December 1982.
- Rand Mining Company (RMC), 1994. Letter from S. Stillar to L. Delaney, U.S. Department of Interior, Bureau of Land Management, Ridgecrest Resource Area and B. Guerrero, Kern County, Planning and Development Services, re: Incremental water consumption use for the Rand Mining Project; June 2, 1994.
- Zheng, C., 1989. PATH3D (v3.0) A Ground-Water Path and Travel-Time Simulator. S.S. Papadopoulos & Associates, Inc., Washington, D.C.

TABLE D-1
PUMPAGE INCLUDED IN MODFLOW MODEL SIMULATIONS

WELL IDENTIFIER	PUMPING RATE (gpm)															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
RMC-4(a)	421	467	472	480	496	457	457	435	413	413	413	271	88	88	88	25
RMC-4(b)	420	418	79	79	79	44	0	0	0	0	0	0	0	0	0	0
RMC-3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
CPD-1	50	50	12	12	12	0	0	0	0	0	0	0	0	0	0	0
CPD-2	50	50	12	12	12	0	0	0	0	0	0	0	0	0	0	0
CPD-3	50	50	12	12	12	0	0	0	0	0	0	0	0	0	0	0
RCWD-1	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
RCWD-2	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
28H01	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698
29N01	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698
29H01	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698
32C01	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698
33H01	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698
3C01	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698

(a) Represents projected average pumping rates including proposed Rand Project.
(b) Represents projected average pumping rates without proposed Rand Project.

gpm = Gallons per minute



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TABLE D-2
MODFLOW MODEL SIMULATION SUMMARY

<u>MODEL CASE</u>	<u>PUMPING WELLS</u>	<u>RAND PROJECT PUMPAGE INCLUDED</u>	<u>PROJECTED DRAWDOWN ILLUSTRATIONS</u>
1	RMC-4 only	No	D-2 through D-4
2	RMC-4 only	Yes	D-5 through D-7
3	A11	No	D-8 through D-10
4	A11	Yes	D-11 through D-13



TABLE D-3

VARIATION OF HYDRAULIC PARAMETERS
FOR SENSITIVITY ANALYSIS

LOCATION	BASELINE K CASE 2 (gpd/ft ²)	LOW K ₂ (gpd/ft ²)	HIGH K ₂ (gpd/ft ²)	BASELINE S CASE 2 (dimensionless)	LOW S (dimensionless)	HIGH S (dimensionless)
North of Garlock Fault	75	32.5	150	0.04	0.004	0.2
Northeast	7.5	3.25	15	0.04	0.004	0.2
Central	150	75	300	0.04	0.004	0.2
Southwest	300	150	600	0.04	0.004	0.2

gpd/ft² = Gallons per day per square foot



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TABLE D-4

SENSITIVITY ANALYSIS RESULTS

LOCATION	YEAR	PROJECTED DRAWDOWNS(feet).....				SENSITIVITY CASE
		CASE 2	MINIMUM	SENSITIVITY CASE	MAXIMUM	
RMC-4	YEAR 6	19.6	10.8	HIGH K	36.1	LOW K
	YEAR 12	15.1	8.3	HIGH K	27.4	LOW K
	YEAR 16	5.3	2.3	LOW S	9.2	LOW K
RCWD Wells	YEAR 6	4.7	1.7	HIGH K	10.5	LOW S
	YEAR 12	5.8	2.5	HIGH K	8.3	LOW K
	YEAR 16	4.1	1.4	LOW S	6.2	LOW K
CPD Wells	YEAR 6	0.0	0.0	HIGH S	4.5	LOW S
	YEAR 12	0.3	0.0	HIGH S	6.3	LOW S
	YEAR 16	0.7	0.0	HIGH S	3.9	LOW K
Agricultural Wells	YEAR 6	2.0	0.2	HIGH K	6.5	LOW S
	YEAR 12	3.3	0.6	HIGH K	4.9	LOW S
	YEAR 16	2.9	0.8	HIGH K	4.0	LOW K
Koehn Lake	YEAR 6	1.0	0.0	HIGH S	4.2	LOW S
	YEAR 12	2.1	0.2	HIGH S	3.2	LOW S
	YEAR 16	2.0	0.4	HIGH S	2.5	LOW K

RMC = Rand Mining Company

K = Hydraulic conductivity

S = Storativity

RCWD = Rand Communities Water District

CPD = Consolidated Placer Mining



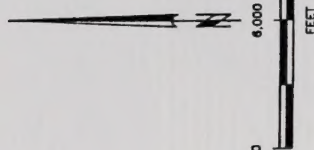
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EXPLANATION

- RMC-4
● RAND MINING COMPANY PRODUCTION WELL
- RMC-2
■ RAND COMMUNITIES WATER DISTRICT PRODUCTION WELL
- CPD-2
▲ CONSOLIDATED PLACER DREDGING PRODUCTION WELL
- 28W01
● AGRICULTURAL PRODUCTION WELL

RECHARGE AREA

150 GPD/FT²
AREA OF EQUAL HYDRAULIC CONDUCTIVITY IN GALLONS PER DAY PER SQUARE FOOT (GPD/FT²)



RAND MINING COMPANY

GROUNDWATER FLOW
MODEL CONFIGURATION

HARGIS + ASSOCIATES, INC.

6/94

FIGURE D-1

PREP BY DPH REV BY LMT RPT NO 945.03 220-0395 18

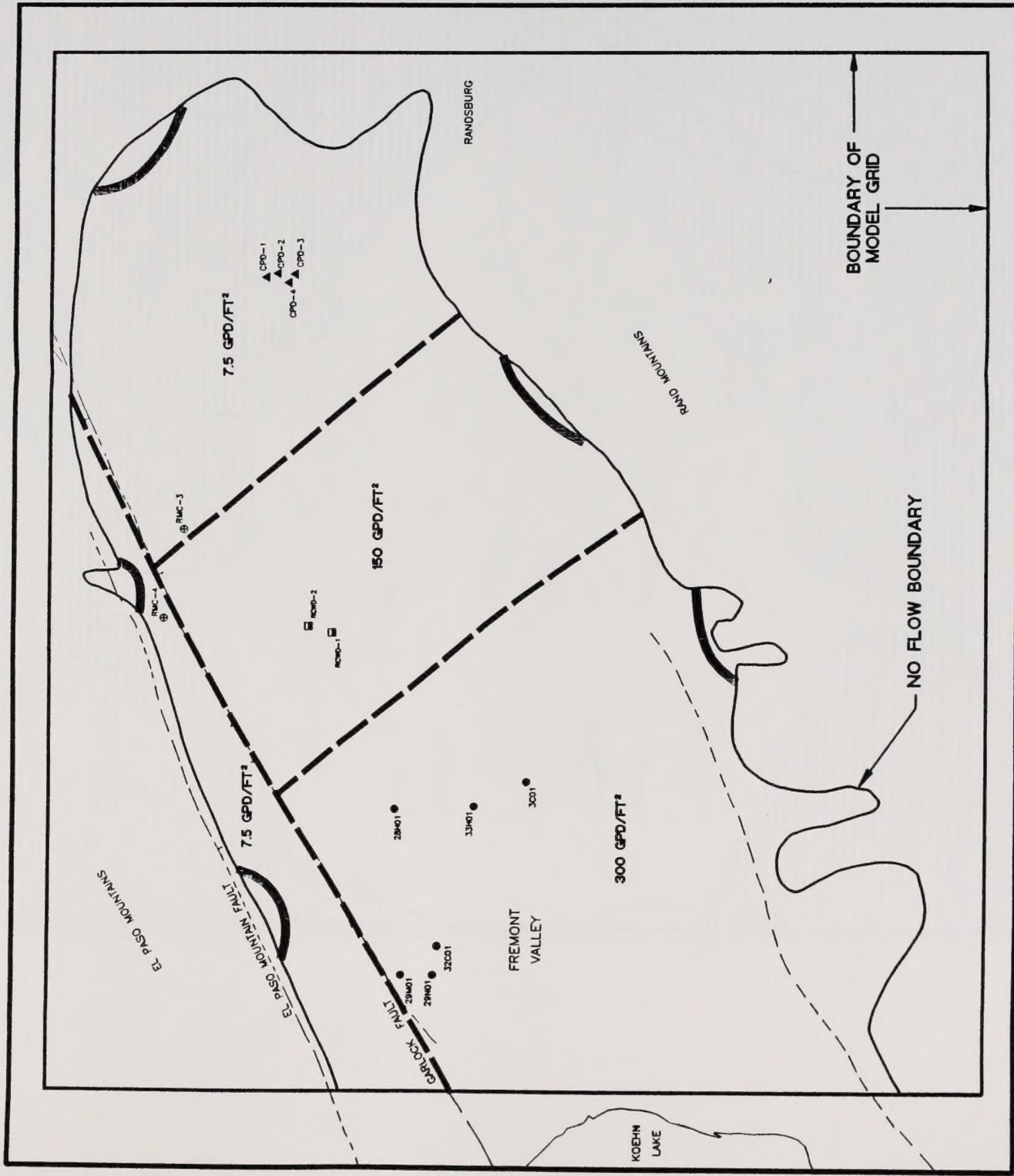


FIGURE D-2. DRAWDOWN AFTER 6 YEARS (CASE 1)

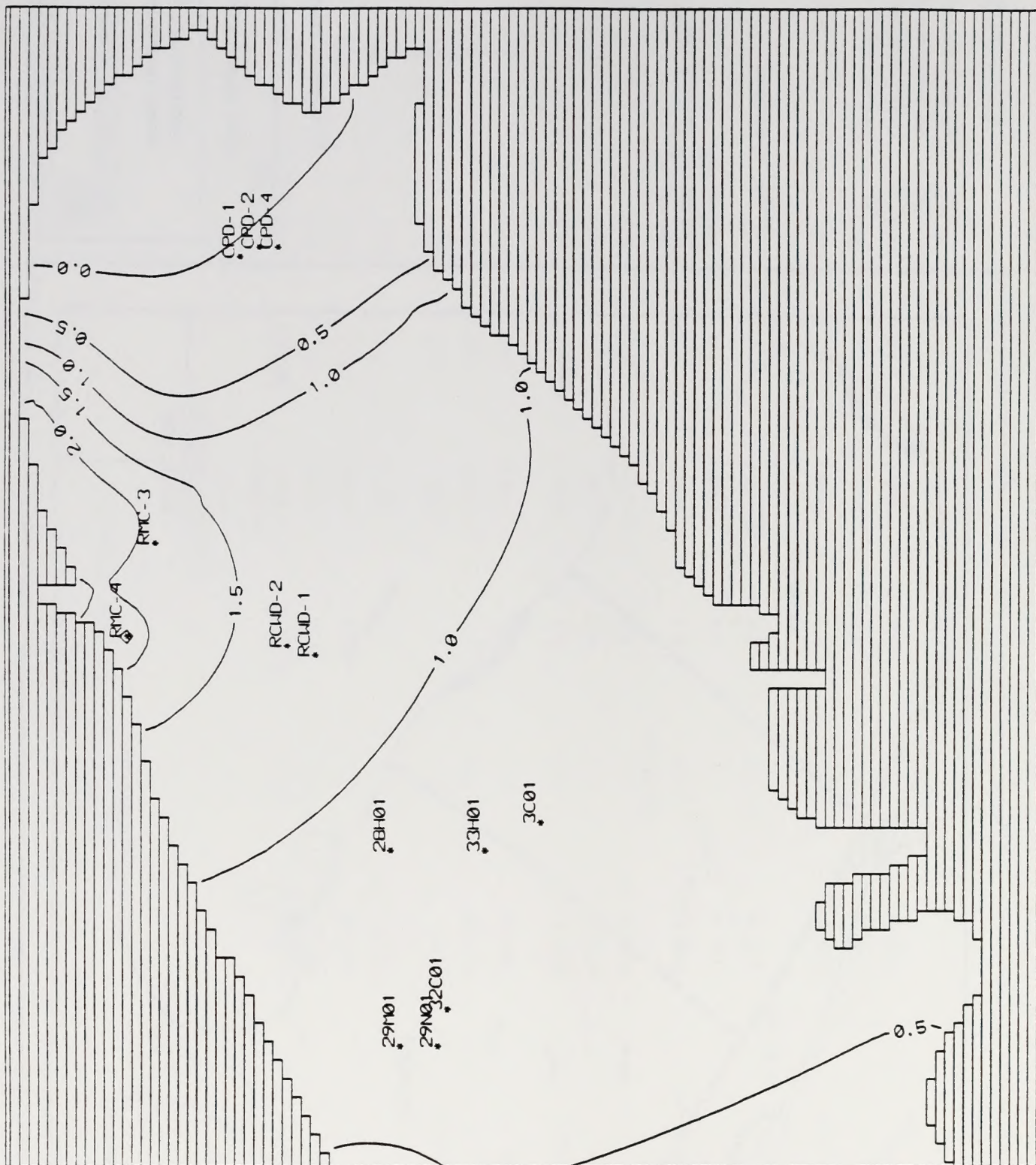


FIGURE D-3. DRAWDOWN AFTER 12 YEARS (CASE 1)

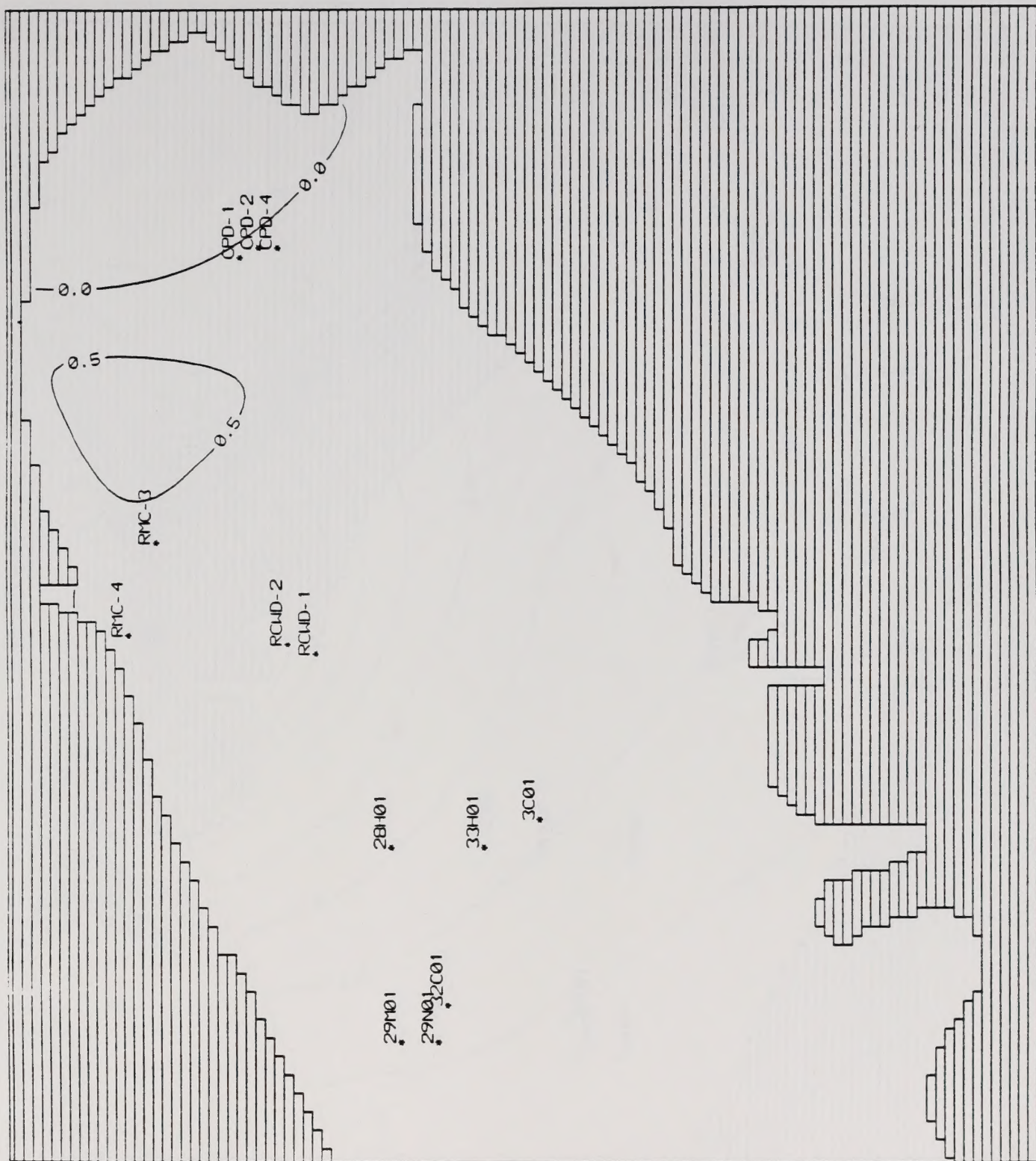


FIGURE D-4. DRAIDOUT AFTER 16 YEARS (CASE 1)



FIGURE D-5. LANDFILL AFTER 6 YEARS (CASE 2)

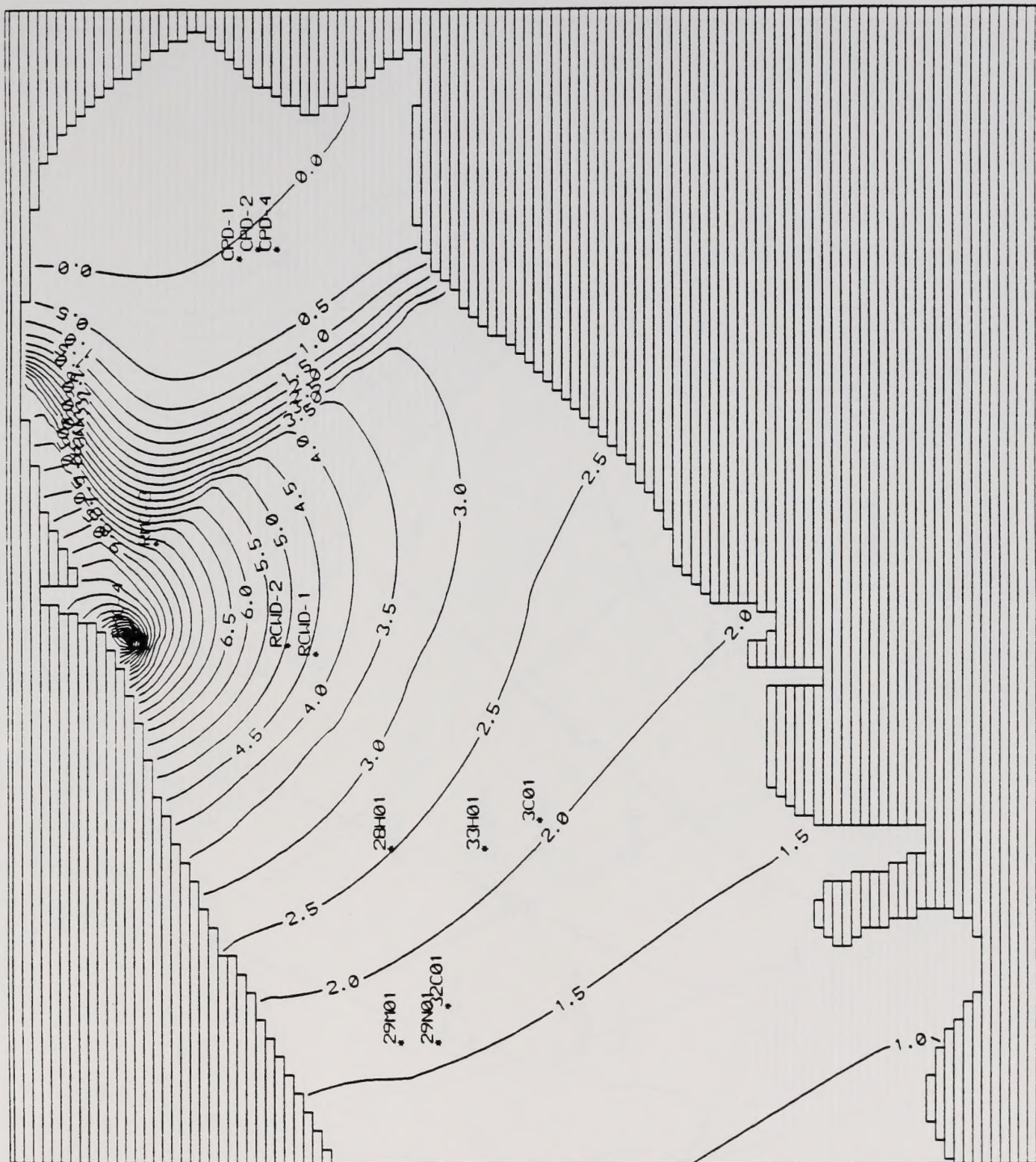


FIGURE D 6. LIPALIDOWN AFTER 12 YEARS (CASE 2)

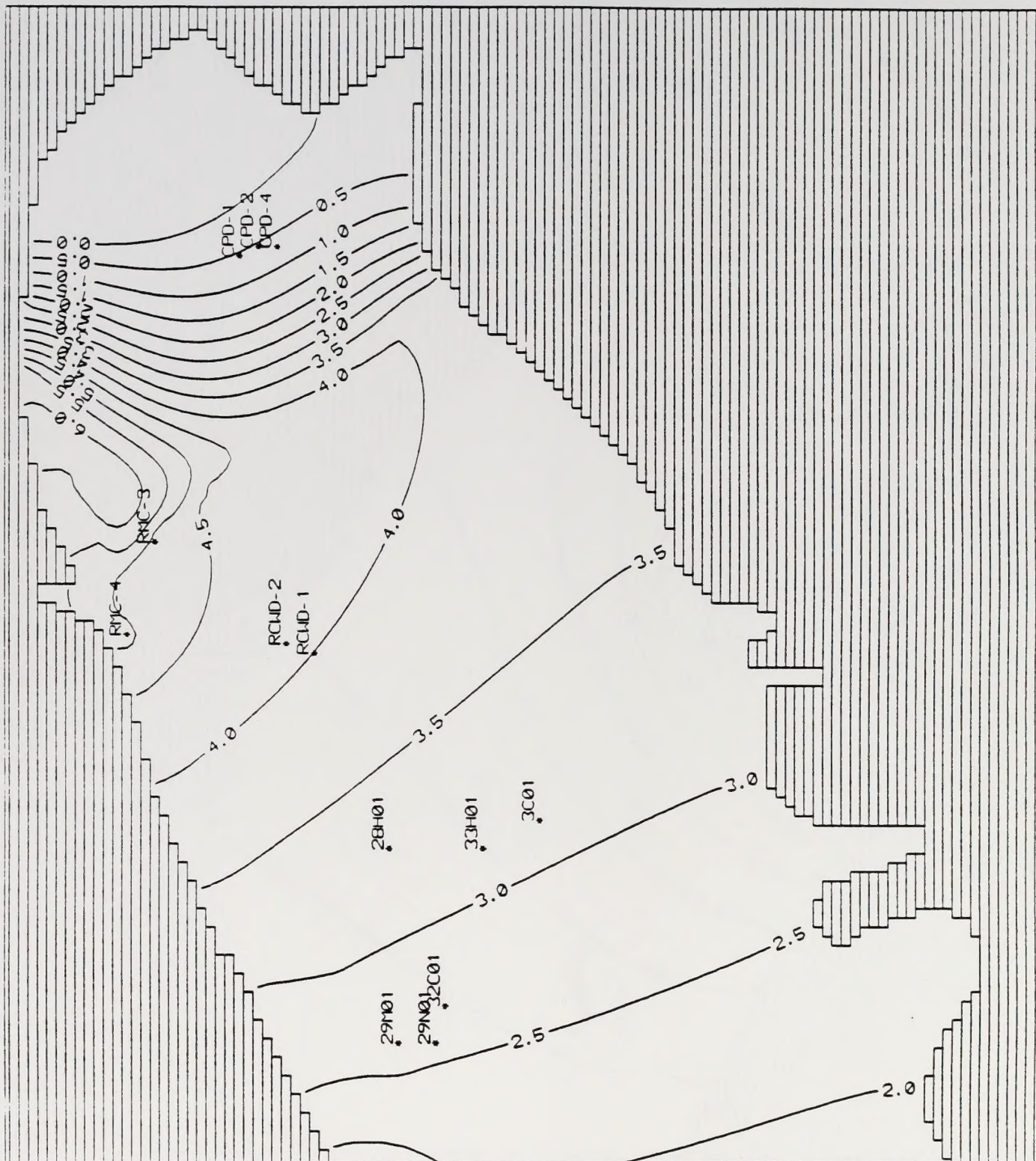


FIGURE D-7. DRAWDOWN AFTER 16 YEARS (CASE 2)

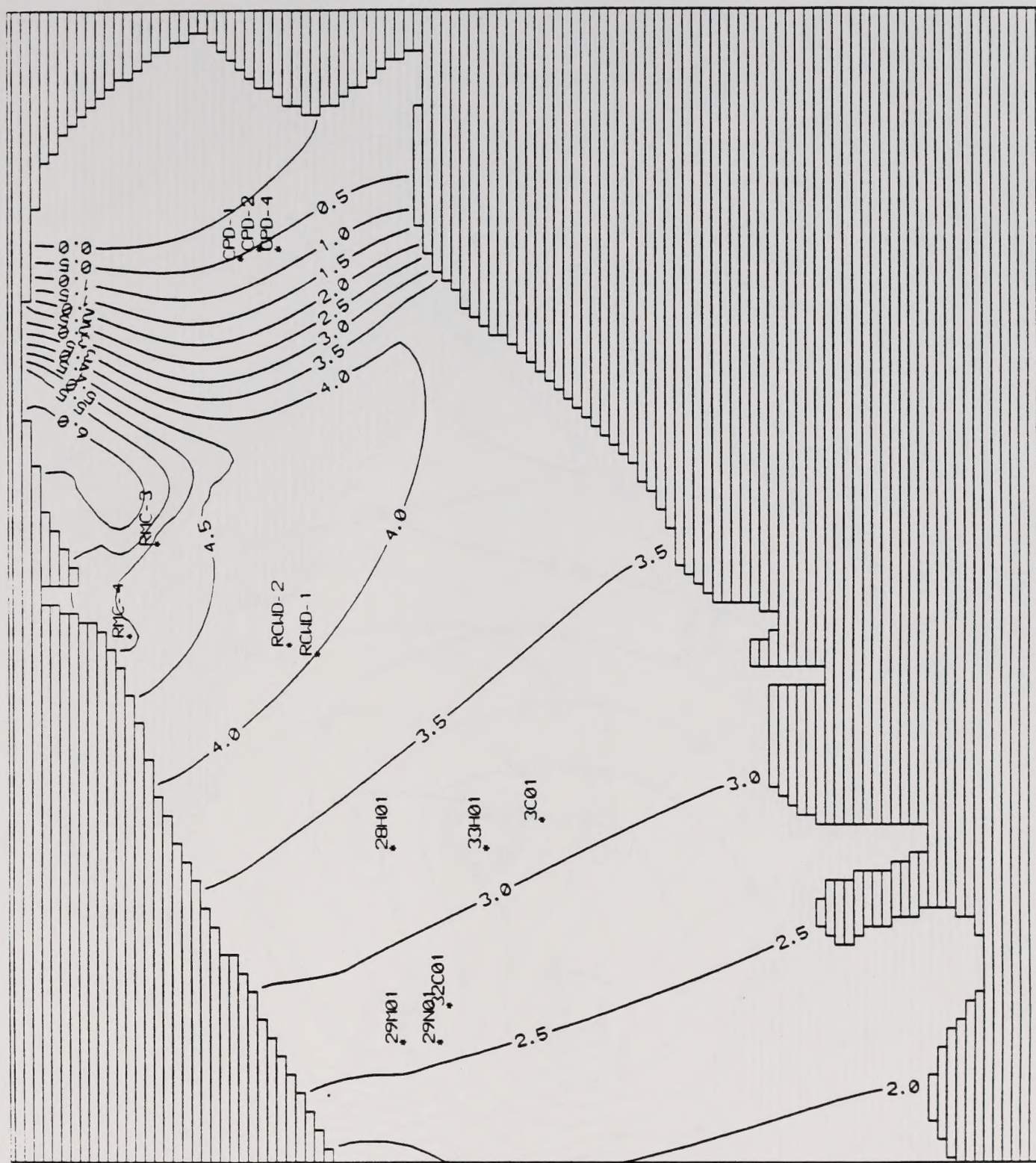


FIGURE D-8. DRAWDOWN AFTER 6 YEARS (CASE 3)

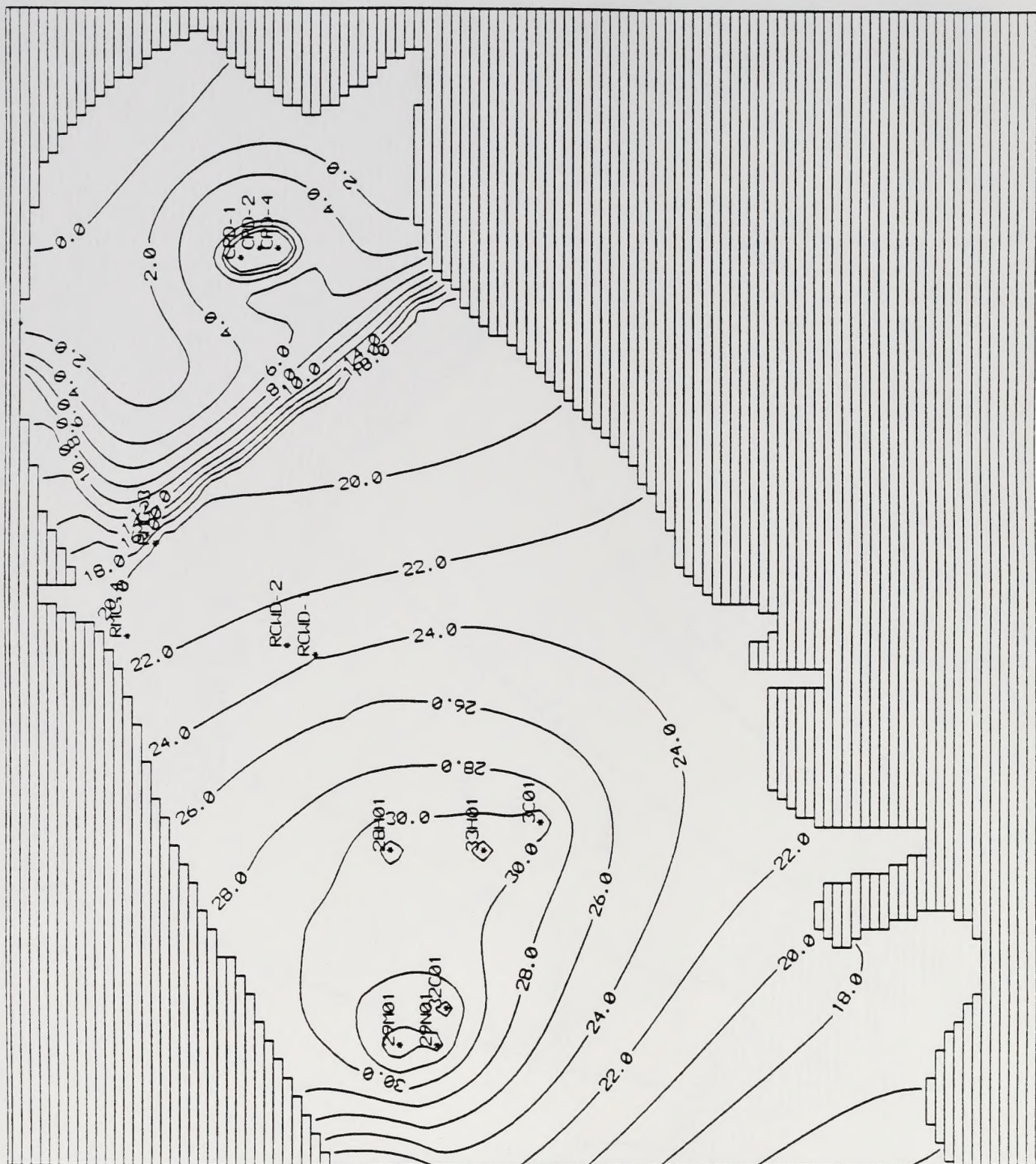


FIGURE D-9. DRAWDOWN AFTER 12 YEARS (CASE 3)

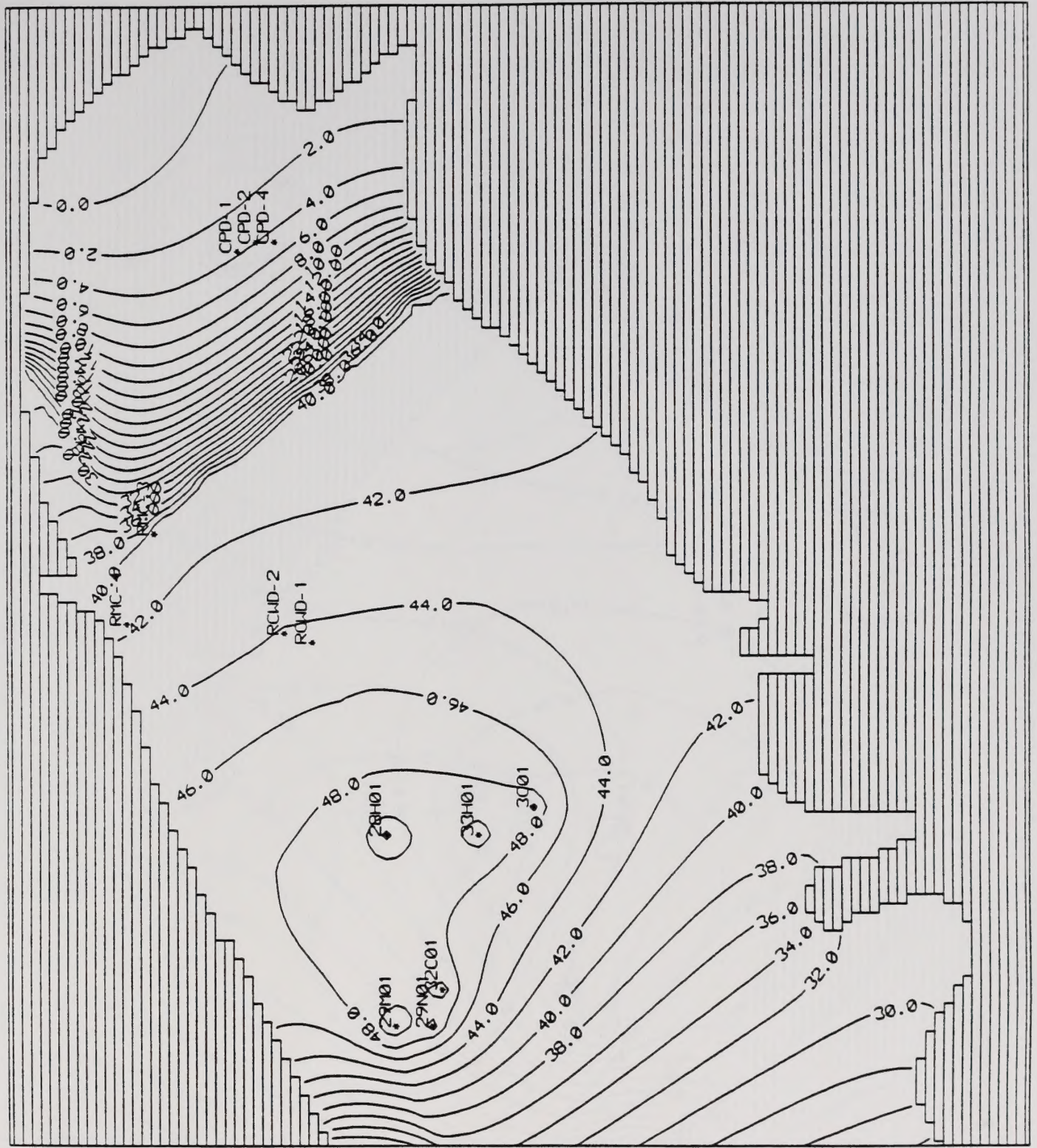


FIGURE D 10. DRAINAGE AFTER 16 YEARS (CASE 3)

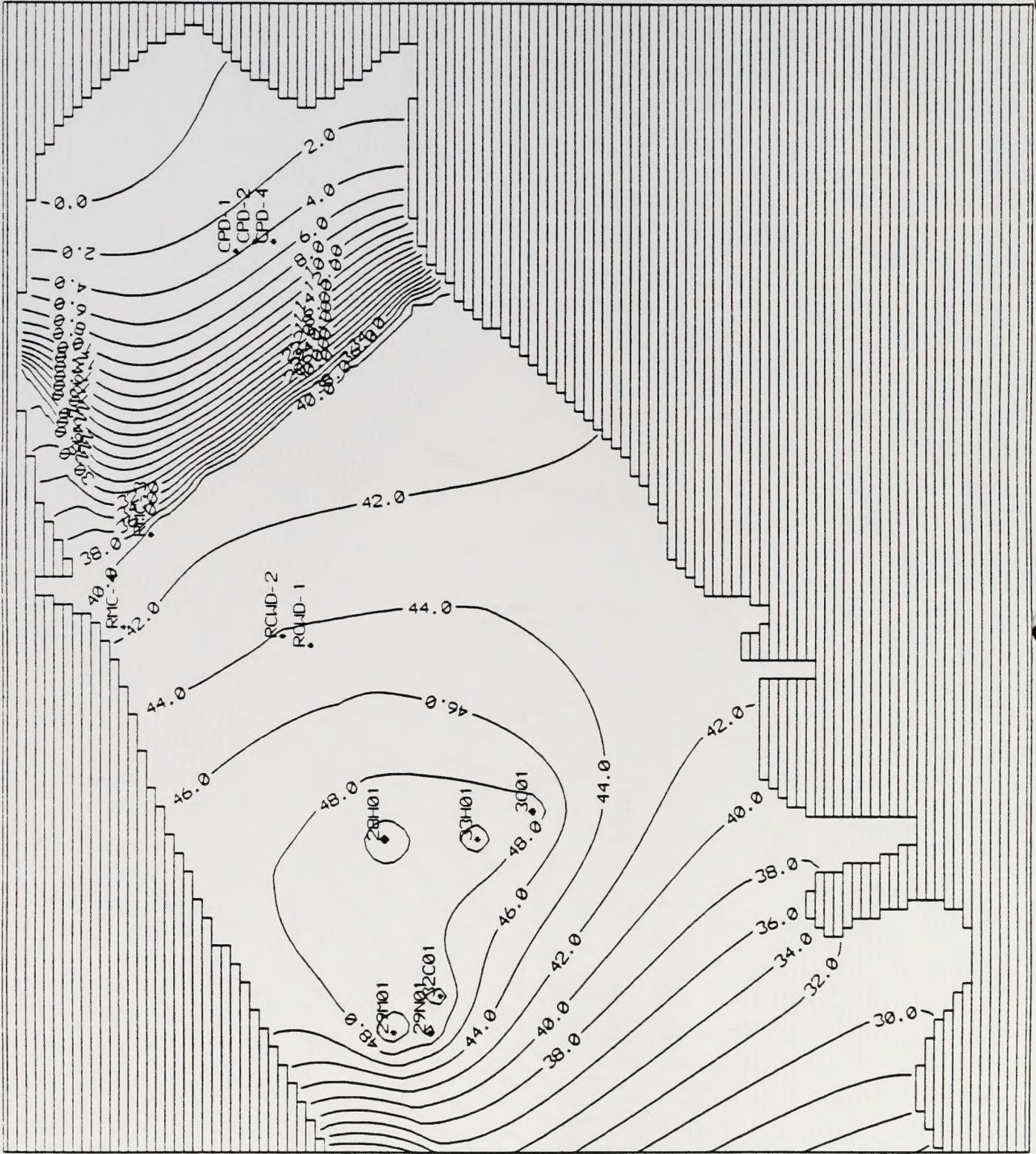


FIGURE D-11. DRAINAGE AFTER 6 YEARS (CASE 4)

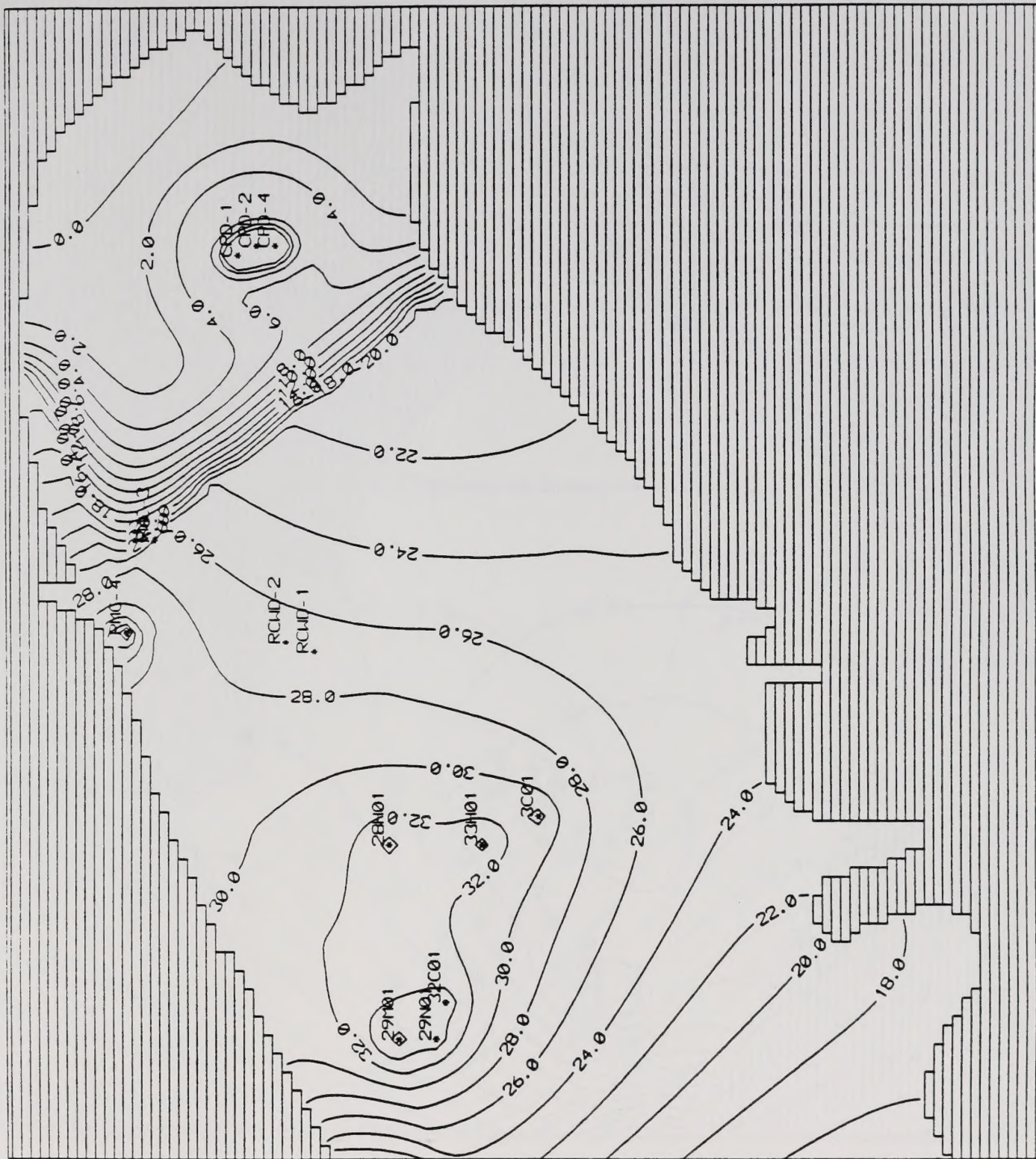


FIGURE D-12. URAIDOWN AFTER 12 YEARS (CASE 4)

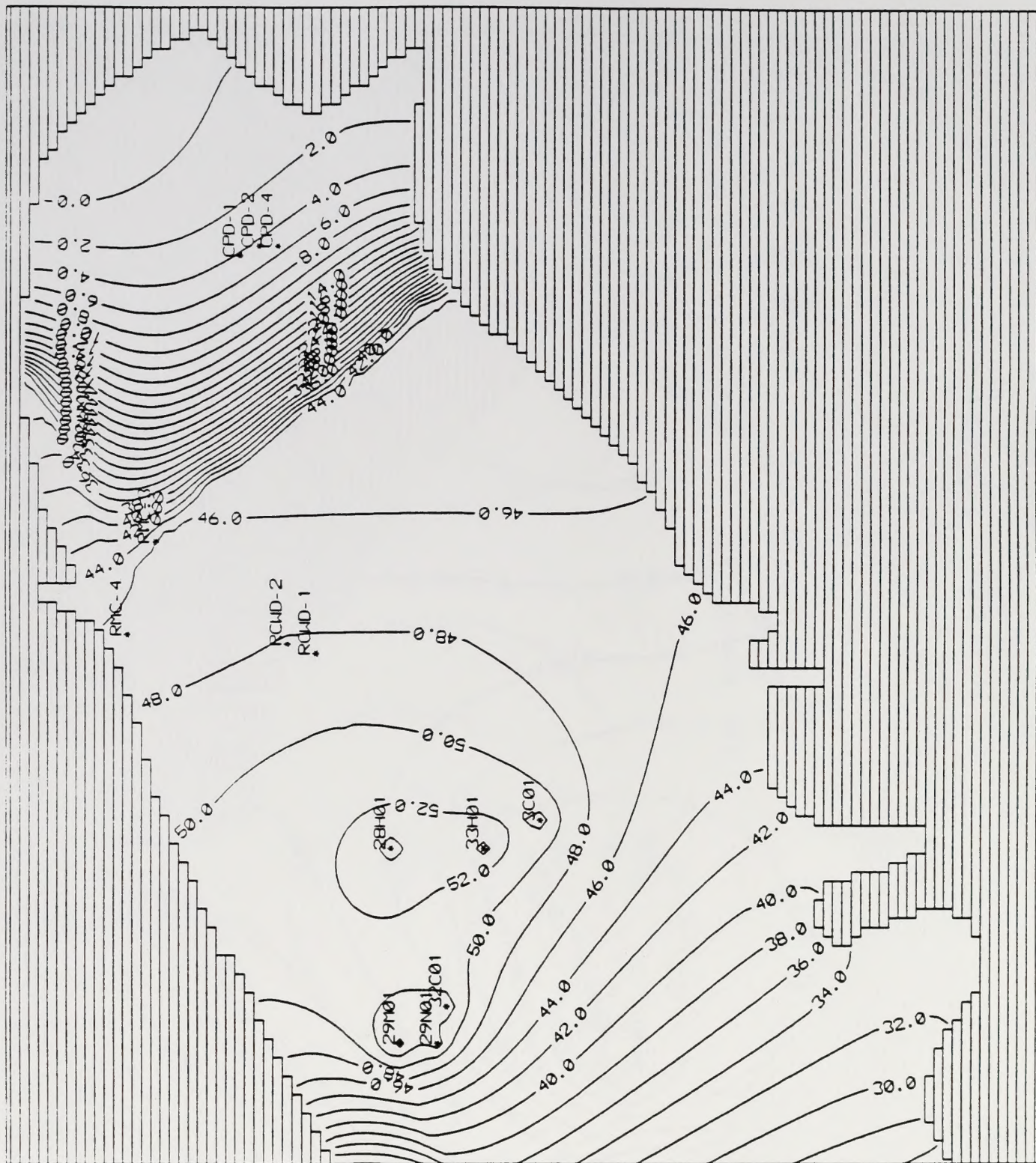


FIGURE D-13. DRAILDOWN AFTER 16 YEARS (CASE 4)

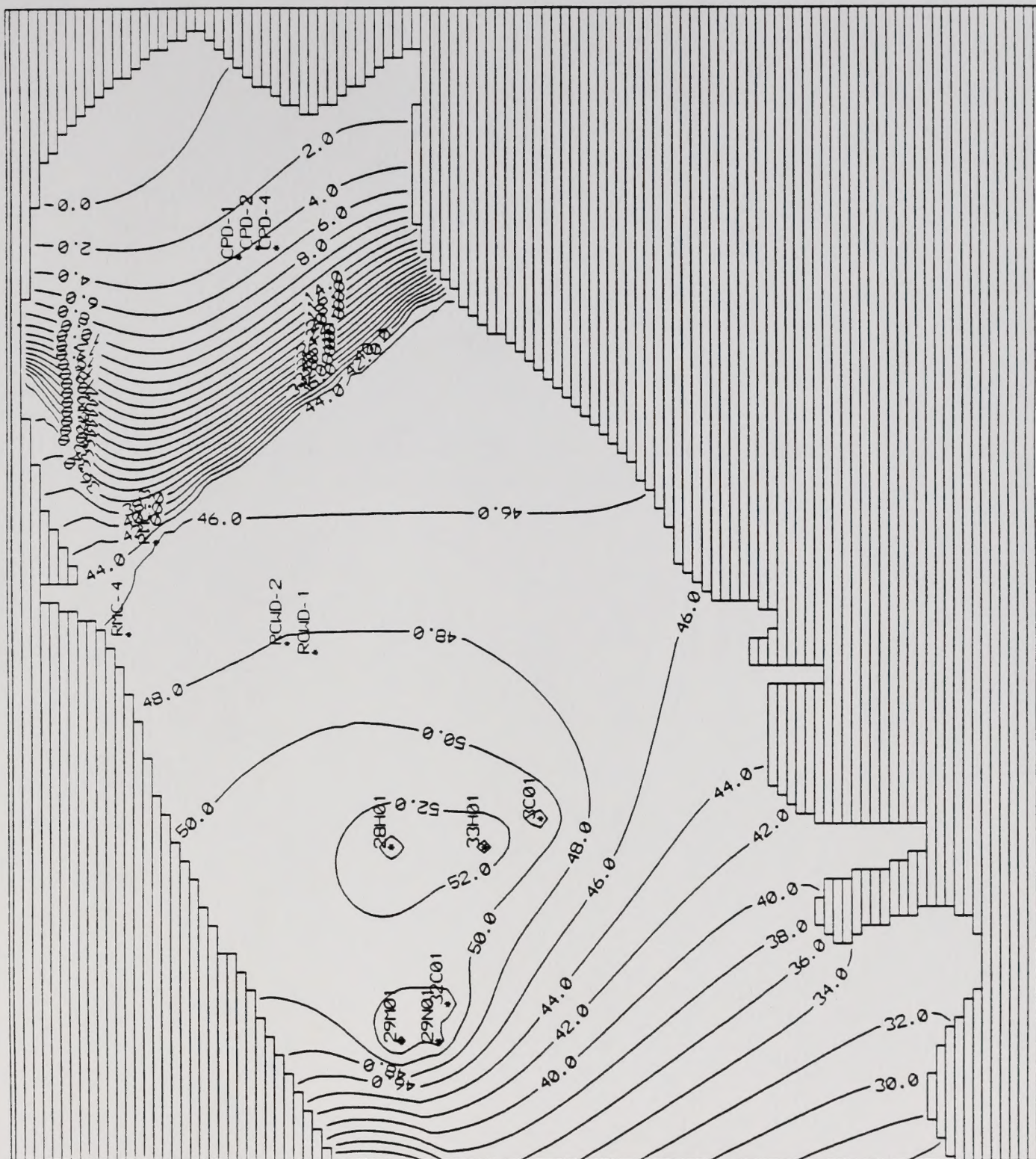
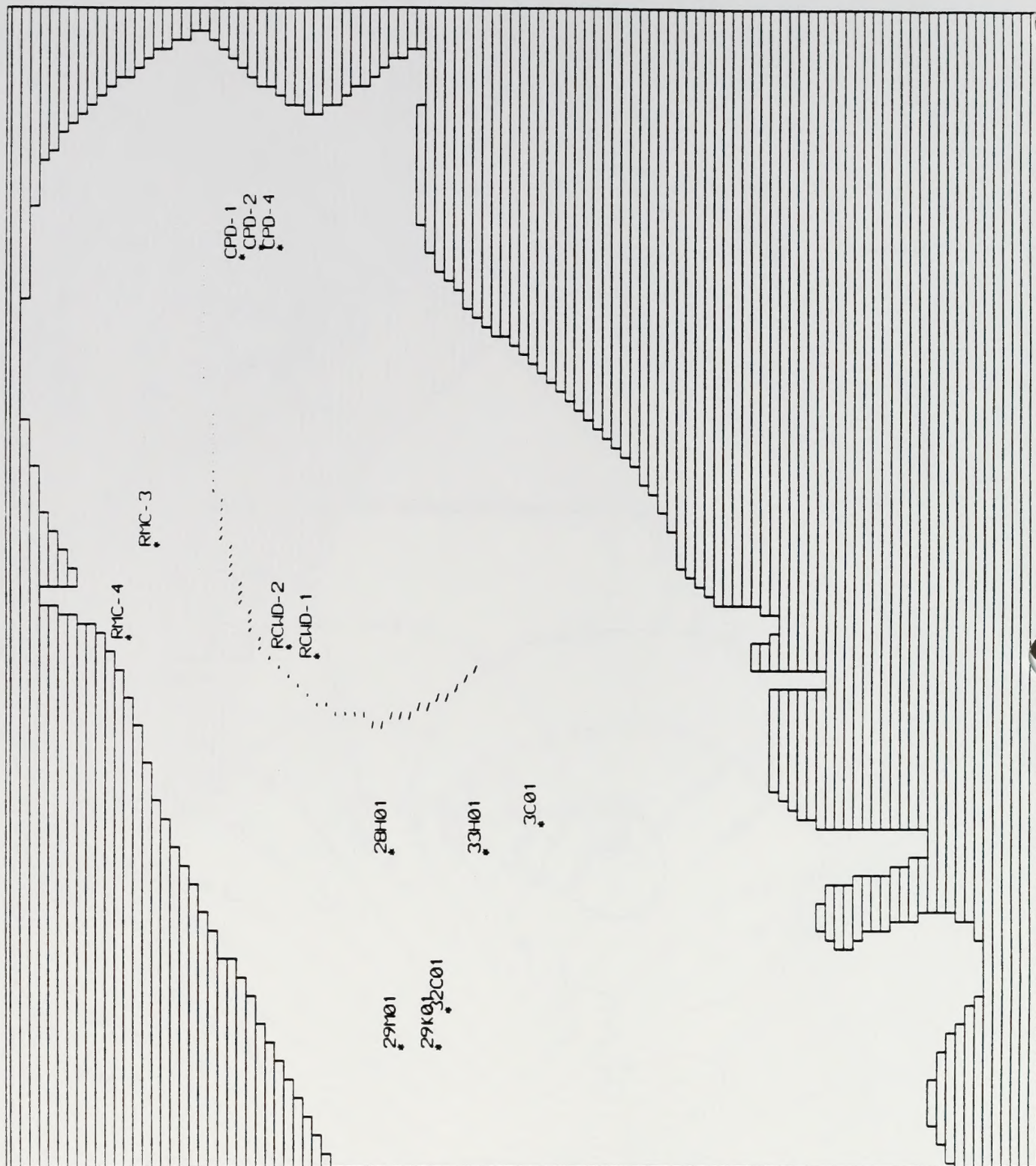


FIGURE D-14. PARTICLE PATH LINES AFTER 16 YEARS



APPENDIX F

**Rand Project Estimated PM₁₀ and Air Toxics Emissions
and Impacts Assessments, Which Includes Appendix I**





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WZI INC.

RAND MINING COMPANY

RAND PROJECT

**ESTIMATED PM₁₀ AND
AIR TOXICS EMISSIONS**

AND IMPACTS ASSESSMENT

December 1993
Revised April 1995

Prepared for:

Rand Mining Company
Post Office Box B
Randsburg, California 93554

Prepared by:

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Bakersfield, California 93309



TABLE OF CONTENTS

EXECUTIVE SUMMARY	Page 1
I. INTRODUCTION	Page 5
II. FACILITY DESCRIPTION	Page 6
III. MODEL SELECTION	Page 7
ISC2	Page 7
ACE2588	Page 8
IV. EMISSIONS CHARACTERIZATION	Page 10
V. DISCUSSION	Page 12
Hazard Assessment	Page 12
Exposure Assessment	Page 13
Adjustments	Page 14
Comparison of Results	Page 16
Carcinogens	Page 16
Acute Health Effects	Page 17
Chronic Health Effects	Page 18
PM ₁₀ Impact Analysis	Page 18
REFERENCES	Page 20

TABLE OF ABBREVIATIONS

ADA	Applicable Degree of Accuracy
AEL	Acceptable Exposure Level
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
EIR/EIS	Environmental Impact Report/Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
HCN	Hydrogen Cyanide
HRA	Health Risk Assessment
KCAPCD	Kern County Air Pollution Control District
OEHHA	California State Office of Health Hazards Assessment
PM ₁₀	Particulate Matter less than 10 microns
PSD	Potential for Significant Deterioration
RMC	Rand Mining Company
TEIR	Toxic Emission Inventory Report
URF	Unit Risk Factors

TABLESTable #

- | | |
|---|--|
| 1 | Rand Project Emissions Quantities |
| 2 | Rand Project Calculated Potential Cancer Risk At Estimated Facility Life for Specified Receptors |
| 3 | Total RMC Facility Calculated Potential Cancer Risk At Estimated Facility Life for Specified Receptors |
| 4 | 70-Year Lifetime Calculated Potential Cancer Risk by Pollutant for Peak Receptor - Rand Project |
| 5 | 70-Year Lifetime Calculated Potential Cancer Risk by Source for Peak Receptor - Rand Project |

FIGURES

Figure #

1 Location Map - Rand Project

EXHIBITSExhibit #

- 1 Agency Comments - Rand Project
- 2 Memorandum from Thomas Paxson Kern County Air Pollution District to
William Larsen, Planning and Development Services

APPENDICES

Appendix

- A ISC2 Input Data
- B ACE2588 Input Data Inhalation Only.
- C ACE2588 Input Data Non-Inhalation Pathways
- D HCN Emission Calculation Procedure
- E Backup Calculations - PM₁₀ Based Emissions
- F Backup Calculations - TSP Based Emissions
- G ACE2588 Output - 70-Year Inhalation (PM₁₀)
- H ACE2588 Output - 70-Year Non-Inhalation (TSP)
- I ISC2 Output - PM₁₀ Concentration Analysis

EXECUTIVE SUMMARY

Rand Mining Company (RMC) proposes to extend its mining activities in the area of Randsburg, California. This document presents an analysis of the estimated PM₁₀ and air toxics emissions and associated health-related impacts related to the anticipated extension. Included is an estimation of air toxic emissions expected under the proposed extension and for the total RMC facility including existing operations. This document compares the estimated health related impacts associated with the proposed action (Rand Project) to the estimated health related impacts resulting from the current pre-project operations for the facility.

The property is located in the Southeast Desert portion of Kern County, near the town of Randsburg. This facility is a surface gold mining operation which processes the ore by cyanide heap leaching with carbon adsorption and electrowinning onto steel wool. RMC began operations on the property in 1985 and expanded operations in 1993 through addition of the Baltic Project. This analysis is prepared in support of an EIR/EIS to allow extension of the life of operations in what is known as the Rand Project.

A review of the potential air toxic emissions and the health related impacts are required for the proposed RMC expansion as part of the EIS/EIR process to address the potential effects on public health.

The California Air Pollution Control Officers Association (CAPCOA) Health Risk Assessment (HRA) guidelines for AB2588 were used as the primary guidance for this assessment of air toxics and impacts assessment. Development of the Rand Project emission estimates used the same methodologies previously used to quantify and identify the 1990 level of emissions in a 1992 Health Risk Assessment.

Estimated emissions of toxic air contaminants were used in an air dispersion model and post processor to calculate ambient air concentrations. These calculated

concentrations were used to arrive at conservative estimates of increased individual carcinogenic risk that might occur as a result of continuous exposure over a 13-year Rand Project lifetime and a 23-year RMC facility lifetime. In similar fashion, calculated concentrations of compounds with non-carcinogenic adverse health effects were used to calculate hazard indices (ratio of expected ambient air concentrations to acceptable exposure levels). The multi-pathway air toxic analysis includes determination of the effects of toxins entering the body through six pathways in addition to the inhalation pathway. They are dermal, soil, water, plants, animal, and mother's milk.

Carcinogenic risk and hazard indices for the Rand Project were calculated at certain specific receptors which are located near the property. These receptors were located at the towns of Randsburg, Johannesburg, and Red Mountain, the Johannesburg School, and the area referred to locally as Dogpatch. Figure 1 shows the location of the specific receptors relative to the RMC property boundary. Among these receptors, the maximum estimated excess cancer risk from the Rand Project emissions is 2.80×10^{-6} (an estimated 2.80 additional cases of cancer per one million population) and is located at the Dogpatch area. With inclusion of the Rand Project, maximum estimated excess cancer risk for the RMC facility will be 3.47×10^{-6} (an estimated 3.47 additional cases of cancer per one million population) at the same location. These estimated risk values are based on the ground level concentration of emissions at the specific receptors. Due largely to the conservativeness of the assumptions inherent in the risk assessment procedures, the risk to actual residents living near the proposed facility will be less than the values indicated. For comparison, in the general population of the United States the risk of developing cancer is approximately 1 in 3 (333,000 per one million population) and the risk of dying from cancer is 1 in 4 (250,000 per one million population).

The maximum estimated acute and chronic hazard indices, among the receptors, from the Rand Project are also located at the Dogpatch receptor but are both significantly less than the action level of 1.0. The hazard index is a measure of the predicted concentration compared to the acceptable exposure level. The maximum estimated

acute hazard index at a specific receptor based on Rand Project emissions is 0.255. The peak estimated chronic hazard index based on Rand Project emissions is 0.0286. These acute and chronic health effects are entirely caused by potential exposure to hydrogen cyanide emissions. As noted, these are not significant because they are below 1.0.

The methods of calculating carcinogenic risk, hazard indices and cancer burden used here are based on a "worst-plausible" situation and are health-conservative in nature. They predict the upper limits of risk based upon the given emission rates. That is to say, the real risks are not likely to be any higher than the predicted numbers and may well be significantly less, possibly zero. This health-conservative approach to assessing risk is the one chosen by EPA, the California Office of Environmental Health Hazards Assessment (OEHHA), and CARB, and is used here for consistency with the concepts and basic assumptions utilized by the reviewing agencies.

This comparison of estimated toxic emissions assumes continuous exposure to the maximum concentration of emissions for the entire life of the project. This method ignores the reduction in exposure realized by periods of time spent away from the residence on vacation, at work, or indoors. Each phase of a risk assessment development contains some level of uncertainty as a result of bias, variability, or uncertain information. This air toxics and potential health impacts assessment is designed to estimate environmental impacts, human exposure, and the potential for adverse effects, which in many cases cannot be directly measured or have not yet occurred. When actual measurements cannot be made, assumptions are required to complete the calculations. A more comprehensive discussion of the conservative assumptions inherent in the analysis of each risk pathway's contribution to the total risk is contained in Section V - Discussion - Exposure Assessment.

Lastly, an analysis of the effect of Particulate Matter less than 10 microns (PM_{10}) emissions on any Class I Wilderness area within 100 kilometers was also performed. This analysis showed that no significant impact occurs at either the Dome Wilderness located to the northwest or at Death Valley National Monument located to the northeast. Impacts of PM_{10} emissions on nearby Wilderness Study Areas were also analyzed and determined not to be significant.

I. INTRODUCTION

In response to comments received by EPA and from Kern County Department of Planning and Development Services, and as part of the EIR/EIS for the proposed Rand Project, this document provides a calculation of incremental Rand Project and total RMC facility PM_{10} emissions and air toxics emissions, and presents a comparison of the potential additional health risk from the Rand Project over the pre-project operations at specific receptors located near the RMC property. (Copies of the comments are included as Exhibit 1.) The specific receptors were grouped as the town of Randsburg, the town of Johannesburg, the school in Johannesburg, the town of Red Mountain, and the area known locally as Dogpatch.

The California Air Pollution Control Officers Association (CAPCOA) Health Risk Assessment (HRA) guidelines for AB2588 were used as the primary guidance for this assessment of air toxics and impacts assessment. The facility is subject to AB2588 requirements and submitted Toxic Emission Inventory Reports (TEIR) to Kern County Air Pollution Control District (KCAPCD) for calendar years 1990 and 1992 and submitted a HRA based upon 1990 emissions. The 1990 TEIR was approved by KCAPCD as was the HRA. The 1992 TEIR was based on methods developed in the 1990 TEIR. The 1992 TEIR is currently being reviewed by KCAPCD.

II. FACILITY DESCRIPTION

RMC operates an open pit gold mining operation near the town of Randsburg, California. RMC began operations on these properties in 1985 and substantially increased operating levels in 1993. Operations at this site, like all mining operations, will have a finite production life. There are currently two operational mines (the Yellow Aster and the Baltic) in which drilling and blasting are being performed. After the material is blasted, it is loaded into large, off-road, mining trucks and transported to either the waste rock pile or the heap leach pad. Each mine has an associated waste rock pile and a heap leach pad. Each heap leach pad has dilute cyanide solution, maintained at an alkaline pH, circulating through the ore to dissolve the precious metals and carry them to the pregnant solution ponds. The precious metals are recovered from the pregnant solution by carbon adsorption and electrowinning onto steel wool. Further processing is done to remove some of the waste materials (slag) from the precious metals in a common furnace before they are shipped offsite. RMC has processed approximately 6.5 million tons of ore-bearing rock and 10 million tons of waste rock or overburden annually from the two existing mines during 1993 through 1995.

RMC is requesting permits to allow additional open pit mining and the building of heap leach pads and waste rock piles for what is known as the Rand Project which is expected to be operated from 1996 through the year 2008. Projected annual processing rates for the Rand Project over its projected 13-year life (1996-2008) are 6.57 million tons of ore bearing rock and 9.85 million tons of waste rock. Further expansion of mining operations may require additional permits and further review of the impact by the facility.

Sources of emissions relating to open pit mining include fugitive dust emissions from drilling, blasting, truck loading, hauling, dozing, and wind erosion, fugitive emissions of hydrogen cyanide from the ponds and the pads, and combustion emissions from operation of the furnace and the diesel driven water pumps.

III. MODEL SELECTION

ISC2

The estimated ambient air concentrations of PM_{10} and chemicals emitted during the operations at the facility were modeled at selected locations using the EPA approved model ISC2 coupled with representative, sequential, short-term meteorological data. ISC2 is a steady-state Gaussian plume dispersion model designed to assess pollutant concentrations from a wide variety of sources including point, area, and volume sources. ISC2 is appropriate for industrial source complexes, rural or urban areas, flat or rolling terrain, transport distances less than 50 kilometers, and 1-hour to annual averaging times. The model options that have been used for this assessment follow the guidelines specified by EPA and CARB. Specific model setup options that have been used to model Rand Project emissions are indicated in the ISC2 model input in Appendix A.

While the topography around the facility is complex, the majority of sources at the RMC facility are fugitives which occur at ground level and the specific receptors are generally located at or below the emission source elevations. These sources are treated as area or volume sources. These types of sources are basically terrain following (i.e. low stack heights with low stack velocities).

ISC2 output yields total concentrations and source contributions of multiple sources at designated receptor coordinates, using the coordinates, stack parameters, and emission rates associated with each source, combined with the meteorology. For purposes of the air toxic evaluation, ISC2 has been utilized with unit emission rates (1.0 gm/sec for point sources and 1.0 gm/sec/m² for area sources).

RMC does not have any on-site meteorological data and less than one full year of meteorological data was available on electronic media from the China Lake Naval Weapons Center. Therefore, meteorological data from Edwards Air Force Base in 1969

were used for this model because it was the nearest available and it was considered representative of the local area. KCAPCD has approved the use of the Edwards meteorological data for RMC in previous studies.

The meteorological data from Edwards was processed to include calculated urban and rural mixing heights based on Holzworth. The calculation method resulted in some abnormally low mixing heights based on discussions with EPA. The morning rural mixing heights were adjusted to be no lower than that calculated at 0900. This modification is reported to have been allowed by EPA on other occasions involving primarily fugitive dust sources.

ISC2 output is passed to a post-processor which analyzes each source contribution for each toxic compound to calculate the potential excess cancer risk and the potential acute and chronic hazard indices at each receptor.

For the comparison of Rand Project and total RMC facility concentration levels, specific receptors were set at Randsburg, Johannesburg, the school in Johannesburg, Red Mountain, and Dogpatch. In addition, the receptor grid utilized for analysis of the estimated excess risk consisted of receptors located on the property boundary spaced 250 meters apart, a fine grid of 100 meter spaced receptors centered roughly on the peak estimated offsite cancer risk location, a medium grid of 250 meter spaced receptors also centered on the peak estimated offsite cancer risk location, and a coarse grid of 2000 meter spaced receptors.

ACE2588

The post-processor (ACE2588) has been widely used in California for compliance with California Assembly Bill 2588 (AB2588). AB2588 requires facilities to quantify air toxic emissions and to prepare health risk assessments if certain thresholds are exceeded. ACE2588 has as input the concentrations calculated by the air dispersion model, air toxic emissions by source, unit risk factors of each toxic compound, and information

relating to multiple pathway effects related to health risk. The ACE2588 analysis is run twice to account for effects of PM_{10} only on the inhalation pathway and effects of TSP on all other pathways. Appendix B and Appendix C contain the ACE2588 input files.

The multi-pathway analysis performed has been based on assumptions approved by the CAPCOA and listed in the Risk Assessment Guidelines dated January 1992. No modifications to these assumptions were made for this facility.

Output from ACE2588 includes concentration of each toxic compound in $\mu g/m^3$, receptor estimated total excess cancer risk, source and pollutant contributions to total cancer risk at specified receptors, receptor maximum acute exposure, and receptor maximum chronic exposure. In addition, graphical representations of the excess risk and relationship to the acute and chronic exposure levels are possible using the output from ACE2588.

IV. EMISSIONS CHARACTERIZATION

Estimates for Rand Project and total RMC facility emissions have been based upon production plans provided by RMC using emission factors approved by EPA, CARB, and KCAPCD and the most recent source tests. These methods can be conservative because of uncertainty surrounding site-specific input parameters. Actual quantities of dust emissions may be higher or lower than those calculated. Development of Rand Project emission estimates used the methodologies of development for existing operations emissions. Determination of Rand Project emission estimates for toxic compounds was based on discussions with RMC personnel regarding projected activities. Emission estimates and methodologies used to quantify and identify the 1990 level of emissions were used to estimate Rand Project emission totals.

The primary sources of toxic air contaminants are fugitive dust emissions resulting from the drilling, blasting, and materials handling of the ore and the overburden. Naturally contained in the fugitive dust are certain elements which are classified as toxic air contaminants. RMC sampled the dust from both the Yellow Aster and the Baltic areas and from both waste and ore rock during the summer of 1993. These samples were analyzed by a third party laboratory to determine the quantity of each of the elements considered to be toxic air contaminants. Results of these samples were used in calculating the toxic fraction of dust estimated to be emitted into the air from each distinct operation. RMC also performed toxics source testing on one of their diesel engines. These results were used to quantify toxic emissions from the engines. Emissions from the furnace were based on Ventura County Air Pollution Control District factors for organics and on material balance for the metals emitted.

Other emission factors used are from EPA AP-42 or have been determined from actual source testing at similar facilities. Reference to the specific emission factors used is also contained in the backup calculations spreadsheets. Appendix A contains the calculations spreadsheets used in determining the quantity of PM₁₀ based Rand Project

emissions. Appendix B contains the spreadsheets used in determining the quantity of TSP based emissions.

Hydrogen cyanide (HCN) emission estimates have been calculated using equations and information summarized in Appendix D. These methods were obtained from literature searches to determine calculation methods for HCN emissions quantification. These methods have been submitted to, and approved by, the KCAPCD for quantifying HCN emissions from cyanide heap leaching operations.

The unit risk factors which are the basis for carcinogenic risk calculations are based upon a 70-year exposure to the toxic chemicals. For this analysis, the Rand Project is assumed to operate from approximately 1996 through 2008, or approximately 13 years, and the excess cancer risk from the Rand Project is calculated based upon this period. RMC began operations in 1985, but in 1993 substantially increased production (to levels equivalent to the Rand project production levels) by adding the Baltic Mine. The excess cancer risk during these eight years of pre-1993 operations is based upon the risk determined in the previously approved 1992 health risk assessment (based on 1990 emissions data). During the three years of 1993 through 1995, prior to the Rand Project but when production rates were already at the Rand production levels, the excess cancer risk has been approximated by using the Rand Project risk factors. Therefore, the maximum estimated cancer risk for the total life of the RMC facility, including the Rand Project, has been determined by adding the maximum risk determined for the eight-year period 1985 through 1992 to the maximum risk for the 16-year period 1993 through 2008.

V. DISCUSSION

Hazard Assessment

OEHHA evaluates chemical substances for cancer health effects, for chronic, non-cancer health effects that may appear years after exposure, and for acute, non-cancer health effects that appear almost immediately after exposure. In some cases, a substance causes more than one type of health effect, and is regulated accordingly. As an example of one of these substances, lead is regulated as a carcinogen, as causing chronic, non-cancer health effects, and as causing acute, non-cancer health effects.

For purposes of this impacts assessment, RMC has determined that the following toxic air contaminants, as identified by CAPCOA, are being emitted, or could be emitted in the future, from its facility:

Acetaldehyde	Lead
Acrolein	Manganese
Arsenic	Mercury
Benzene	Naphthalene
Beryllium	Nickel
Cadmium	PAHs
Chlorobenzene	Propylene
Chromium VI	Selenium
Copper	Toluene
Formaldehyde	Xylene
Hydrochloric Acid	Zinc
Hydrogen Cyanide	

Table 1 lists all regulated air toxics which are expected to be emitted by RMC and the sources where they may be emitted from the Rand Project. The emission rates (lbs per year and lbs per hour) used for modeling purposes are included in Table 1.

Exposure Assessment

The estimated emission rates of toxic compounds from each source at the facility were either calculated or measured by actual source testing. Appendix E and Appendix F detail the emissions estimates used for RMC facility operations after the Rand Project expansion.

The methods of calculating carcinogenic risk, hazard indices and cancer burden used here are based on a "worst-plausible" situation and are health-conservative in nature. They predict the upper limits of risk based upon the given emission rates. That is to say, the real risks are not likely to be any higher than the predicted numbers and may well be significantly less, possibly zero. This health-conservative approach to assessing risk is the one chosen by EPA, the California Office of Environmental Health Hazards Assessment (OEHHA), and CARB.

The multi-pathway air toxic analysis includes determination of the effects of toxins entering the body through six pathways in addition to the inhalation pathway. They are dermal, soil, water, plants, animal, and mother's milk. For the Rand Project, the water, plants, and animal pathways are not considered because there are no open sources of water, no known backyard gardens in the area, and no commercial cattle or poultry is raised nearby. In addition, the mother's milk pathway is not considered because it is affected only by toxins not present in the RMC emissions. The conservative assumptions made by the California Air Resources Board (CARB) are used in the analysis of each of the remaining pathways. The soil pathway is the ingestion of dust which is deposited on food eaten by the individual. Assumptions in the soil pathway analysis include a mixing depth of only 1 centimeter in the soil and 110 mg/day of soil consumption.

Each phase of an impact assessment development contains some level of uncertainty as a result of bias, variability, or uncertain information. This air toxics and potential health impacts assessment is designed to estimate environmental impacts, human

exposure, and the potential for adverse effects, which in many cases cannot be directly measured or have not yet occurred. When actual measurements cannot be made, assumptions are required to complete the calculations.

Human exposure was estimated for a hypothetical individual residing continuously at the point of maximum impact. This approach assumes that the individual is always in the same location, exposed to the same ambient concentration, which would seldom, if ever, occur. Periods spent away from the residence due to vacation or work would result in lower exposures and lower estimated excess cancer risk to the individual.

Exposure was estimated using the procedures and assumptions presented in the CAPCOA AB2588 guidelines. In several ingestion pathways, the CAPCOA guidelines give a mechanism for incorporating site-specific information. For purposes of this analysis, the defaults included in the guidelines were used.

Acceptable exposure levels (AELs) are used as indicators of potential adverse, non-carcinogenic, health effects. They are generally set by agencies based on the most sensitive adverse health effect reported in literature. AELs are designed with a margin of safety to protect the most sensitive individuals. A hazard index of 1 represents the acceptable exposure for an individual substance. Different substances may affect different target organs and exposure to two or more substances which may affect the same target organ are assumed to be additive. However, exposures above the acceptable exposure levels (i.e. a total hazard index greater than one) do not necessarily equate to significant health risks because of the margin of safety included in the AEL. AELs have been established for various substances for both maximum short-term (one-hour) exposure levels and maximum long-term exposure levels.

Adjustments

Mixing Height - The meteorological data set from Edwards contained some early morning mixing heights which were extremely low. These low mixing heights resulted

in area source emissions with low stacks and low exit velocities bouncing emissions between the ground and the mixing height for long distances. The early morning mixing heights were modified to set the 9:00 AM value as the lowest mixing height on any given day throughout the year.

Applicable Degree of Accuracy - After estimation of the total quantity of each chemical emitted by RMC, a determination was made as to whether the total exceeded the applicable degree of accuracy (ADA) for reporting emissions for the particular chemical under AB2588. If the total was less than the respective ADA, then the chemical was not included in the impacts assessment.

Project Life - The unit risk factors (URF) assigned to each cancer-causing chemical are based in part on the assumption of a 70 year exposure to the chemical. The estimated excess risk associated with potential emissions from the RMC facility should be based upon the facility life. RMC has stated that the Rand Project will be operated from approximately 1996 through 2008. RMC started operations on the property in 1985. In 1992, RMC completed a Health Risk Assessment based upon 1990 actual emissions which showed no excess risk from facility emissions.

The Rand Project as designed will be completed in 13 years. The estimated excess cancer risk from the facility based on projected emissions has therefore been reduced using a factor of 13/70 to reflect potential excess risk based upon only thirteen years at the projected emissions rate. Table 2 shows the total estimated cancer risk at 70 years and at 13 years for each specific receptor for the Rand Project. Factoring the estimated excess cancer risk was discussed with the KCAPCD and verbally approved provided the estimated project life is realistic and conservative. RMC anticipates an APCD permit condition limiting operations to 13 years from commencement.

Maximum estimated cancer risk (MECR) for the total RMC facility (Table 3) has been calculated based on a sixteen year life at current production levels (3 years existing operations (1993-1995), and 13-years Rand Project (1996-2008)) and the maximum

MECR from the 1992 HRA. The Rand Project MECR has been subtracted from the total facility MECR to get the pre-project MECR.

Comparison of Results

Carcinogens - Incremental estimated maximum excess cancer risk from the Rand Project at a specific receptor is 2.80×10^{-6} (an estimated 2.80 additional cases of cancer per one million population) and is located at Randsburg. This compares to a total RMC facility estimated risk of 3.47×10^{-6} (an estimated 3.47 additional cases of cancer per one million population). Therefore estimated maximum excess cancer risk from current operations is 0.67×10^{-6} . Appendices G & H contain ACE2588 output for inhalation and non-inhalation analysis respectively. Dogpatch is physically located nearest to the project. The towns of Randsburg, Johannesburg, and Red Mountain are the other specific receptors evaluated. The Rand Project also presents estimated excess risk greater than 1×10^{-6} to each of these towns except for Johannesburg. The location of the school in Johannesburg was determined to have an estimated excess risk of 2.36×10^{-6} (an estimated 2.36 additional cases of cancer per one million population) compared to existing operations maximum estimated excess risk of 0.57×10^{-6} (an estimated 0.57 additional cases of cancer per one million population). For comparison, in the general population of the United States the risk of developing cancer is approximately 1 in 3 (333,000 per one million population) and the risk of dying from cancer is 1 in 4 (250,000 per one million population). This cancer risk of the general population is currently recognized by the Kern County APCD, and is cited by the Bay Area AQMD from "The Probabilities of Eventually Developing or Dying of Cancer - United States, 1985" by Herbert Seidman et. al., as published in The Cancer Journal for Clinicians, volume 35, number 1, January - February 1985.

Due largely to the conservative nature of the assumptions inherent in the risk assessment procedures, the risk to actual residents living near the proposed facility will be less than the values indicated. Table 4 shows the estimated 70-Year lifetime cancer risk by pollutant for Rand Project emissions for the peak receptor. Over 78 percent of

the estimated excess risk at the maximum receptor comes from exposure to arsenic compounds which are contained in the fugitive dust emissions relating to the normal activities of the facility.

Arsenic is reported in the EPA TSCA Inventory. Arsenic and its compounds are on the Community Right To Know List. For purposes of the impacts assessment, all arsenic (all sources and all forms) is reported as elemental arsenic. Arsenic is classified as a human carcinogen based on "weight-of-evidence" from increased lung cancer mortality in populations exposed primarily through inhalation (smelter workers), and increased skin cancer incidence in several populations consuming drinking water with high arsenic concentrations (Taiwan, Chile, Argentina and Mexico). No excess skin cancer incidence has been observed in United States residents consuming relatively high levels of arsenic in drinking water. Additionally, there has not been consistent demonstration of arsenic carcinogenicity in test animals for various chemical forms of arsenic administered by different routes to several species.

For the Rand Project truck loading and blasting of the ore and waste accounts for 59.0 percent of the estimated excess risk with wind erosion accounting for an additional 33.7 percent. Table 5 shows the estimated 70-Year lifetime cancer risk by source for Rand Project emissions for the peak receptor.

Acute Health Effects - Both the Rand Project analysis and the total facility analysis show that exposure to air toxics which may have acute effects on the central nervous system (the maximally exposed toxicological endpoint) have estimated hazard indices less than 1.0. Hydrogen cyanide, lead, and nickel are the principal contributors to acute effects estimates. Exposure from the Rand Project is less than the AEL defined for each of these chemicals individually and presents an estimated hazard index of only 0.255 combined. Thus, no significant health effects are anticipated to occur from acute exposure to any air toxics.

Chronic Health Effects - Both the Rand Project analysis and the total RMC facility analysis show that exposure to air toxics which may have chronic effects on the central nervous system (the maximally exposed toxicological endpoint) have estimated hazard indices less than 1.0. Hydrogen cyanide, arsenic, manganese, and lead all may have chronic effects on the central nervous system. All estimated exposures are individually and collectively less than the AEL, therefore, no significant health effects are anticipated to occur from chronic exposure to any air toxics.

PM₁₀ Impact Analysis

Telephone contact with EPA Region IX in San Francisco revealed that sources of fugitive emissions which are not covered by local permits and regulations are also not included in the total emissions used to classify a stationary source as a major source. Using this criteria, the Rand Project is not considered a major source and is not subject to Prevention of Significant Deterioration (PSD) requirements.

Even though the Rand Project is not considered a major source, an analysis of the effect of estimated PM₁₀ emissions on the Class I areas within 100 kilometers was performed. This analysis is required when a PSD source increases pollutant concentration by 1 $\mu\text{g}/\text{m}^3$ or more (24-hour average) in a Class I area. The Class I areas within 100 kilometers are Dome Wilderness to the northwest, and Death Valley National Monument to the northeast. Appendix G contains the output from ISC2 for the PM₁₀ concentration analysis. This analysis of the RMC total facility shows an estimated maximum increase in PM₁₀ concentration of only 0.304 $\mu\text{g}/\text{m}^3$ at Death Valley and 0.294 $\mu\text{g}/\text{m}^3$ at Dome. Therefore no significant impact is expected to occur at the nearest Class I areas.

In addition to the Class I areas, PM₁₀ concentrations were modeled at other wilderness areas which are closer to the Rand Project but are not Class I areas, and at adjacent population centroids or sensitive receptors. In these areas 24-hour average PM₁₀

concentrations of less than 10 mg/m^3 were modeled at the additional wilderness areas and less than 32 mg/m^3 at the population centroids.

VI. REFERENCES

ARB, 1992. Amendments to the "Hot Spots" Emissions Inventory Criteria and Guidelines Regulation, California Air Resources Board, March.

CAPCOA, 1992. CAPCOA Air Toxics "Hot Spots" Program Risk Assessment Guidelines, Prepared by the AB2588 Risk Assessment Committee of the California Air Pollution Control Officers Association (CAPCOA), January.

U.S. Environmental Protection Agency, 1986. Guidelines on Air Quality Models. EPA-450/2-78-027R. U.S. EPA, Research Triangle Park, NC.

TABLE 1

1998 ESTIMATED
EMISSIONS

	lb/yr Chlorobenzene	lb/hr Chlorobenzene	lb/yr Chromium VI	lb/hr Chromium VI	lb/yr Copper	lb/hr Copper	lb/yr Silica	lb/hr Silica	lb/yr Formaldehyde	lb/hr Formaldehyde	lb/yr HCL	lb/hr HCL
1001	0	0	1.950E-04	9.875E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
1002	0	0	2.156E-04	9.875E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
1003	0	0	4.385E-02	4.175E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
	0	0	4.886E-02	4.175E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
	0	0	YA	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
Truck Load - Lamont	0	0	Lamont	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
1004	0	0	4.307E-03	5.239E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
1005	0	0	5.505E-04	2.118E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
	0	0	2.648E-04	9.200E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
1006	0	0	2.504E-03	6.418E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
1007	0	0	8.231E-04	1.910E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
	0	0	2.979E-02	3.400E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
Barren Pond - YA	0	0	0	0	0	0	0	0	0	0	0	0
Barren Pond - Lamont	0	0	0	0	0	0	0	0	0	0	0	0
Pregnant Pond - YA	0	0	0	0	0	0	0	0	0	0	0	0
Pregnant Pond - Lamont	0	0	0	0	0	0	0	0	0	0	0	0
Ore Heap - YA	0	0	0	0	0	0	0	0	0	0	0	0
Ore Heap - Lamont	0	0	0	0	0	0	0	0	0	0	0	0
Adsorption	0	0	0	0	0	0	0	0	0	0	0	0
1010	0	0	0	0	0	0	0	0	0	0	0	0
1018	0	0	1.775E-04	1.103E-06	0	0	0	0	0.000E+00	0.000E+00	0	0
1021	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1021A	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1022	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1023	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1025	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1027	0	0	0	0	0	0	0	0	0	0	0	0
Diesel Tank	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Tank	0	0	0	0	0	0	0	0	0	0	0	0
1028	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1029	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1998 TOTALS	0.000E+00	0.000E+00	1.315E-01	8.516E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

TABLE 1

1998 ESTIMATED EMISSIONS												
W/O ND & ADA CHEMICALS												
	lb/yr HCN	lb/hr HCN	lb/yr Lead	lb/hr Lead	lb/yr Manganese	lb/hr Manganese	lb/yr Mercury	lb/hr Mercury	lb/yr Nickel	lb/hr Nickel	lb/yr Naphthalene	lb/hr Naphthalene
1001	0	0	1.748E-02	9.796E-06	2.372E-01	1.343E-04	0.000E+00	0.000E+00	2.035E-02	1.114E-05	0	0
1002	0	0	1.932E-02	9.796E-06	2.621E-01	1.343E-04	0.000E+00	0.000E+00	2.249E-02	1.114E-05	0	0
	0	0	3.929E+00	4.142E-02	5.332E+01	5.678E-01	0.000E+00	0.000E+00	4.574E+00	4.709E-02	0	0
1003	0	0	4.376E+00	4.142E-02	5.938E+01	5.678E-01	0.000E+00	0.000E+00	5.095E+00	4.709E-02	0	0
	0	0	4.008E-03	2.261E-06	4.403E-01	2.500E-04	0.000E+00	0.000E+00	7.283E-01	4.176E-04	0	0
1004	0	0	4.430E-03	2.261E-06	4.867E-01	2.500E-04	0.000E+00	0.000E+00	8.050E-01	4.176E-04	0	0
	0	0	4.272E-01	5.197E-05	5.857E+00	7.125E-04	0.000E+00	0.000E+00	4.858E-01	5.910E-05	0	0
1005	0	0	4.140E-02	1.592E-04	5.505E-01	2.118E-03	0.000E+00	0.000E+00	5.043E-02	1.940E-04	0	0
Dozing - Ore Lamont	0	0	1.991E-02	6.918E-05	2.648E-01	9.200E-04	0.000E+00	0.000E+00	2.425E-02	8.427E-05	0	0
	0	0	2.484E-01	6.366E-04	3.405E+00	8.728E-03	0.000E+00	0.000E+00	2.824E-01	7.239E-04	0	0
Dozing - Waste YA	0	0	8.165E-02	1.895E-04	1.119E+00	2.598E-03	0.000E+00	0.000E+00	9.285E-02	2.154E-04	0	0
	0	0	2.955E+00	3.373E-04	4.052E+01	4.624E-03	0.000E+00	0.000E+00	3.361E+00	3.835E-04	0	0
1006	0	0	0	0	0	0	0	0	0	0	0	0
1007	2.873E+04	3.230E+00	0	0	0	0	0	0	0	0	0	0
Barren Pond - YA	1.078E+04	1.210E+00	0	0	0	0	0	0	0	0	0	0
	2.992E+04	3.370E+00	0	0	0	0	0	0	0	0	0	0
1009	1.123E+04	1.260E+00	0	0	0	0	0	0	0	0	0	0
	7.119E+01	8.127E-03	0	0	0	0	0	0	0	0	0	0
Ore Heap - YA	2.921E+02	3.334E-02	0	0	0	0	0	0	0	0	0	0
	1.284E+02	9.000E-03	0	0	0	0	0	0	0	0	0	0
1010	0	0	0	0	0	0	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00
1018	0	0	0	0	0	0	0.000E+00	0.000E+00	0	0	0.000E+00	0.000E+00
1021	0	0	9.475E-04	1.327E-07	9.475E-04	1.327E-07	0.000E+00	0.000E+00	1.572E-02	2.201E-06	0.000E+00	0.000E+00
2021A	0	0	1.151E-03	1.643E-07	1.151E-03	1.643E-07	0.000E+00	0.000E+00	1.910E-02	2.726E-06	0.000E+00	0.000E+00
1022	0	0	8.884E-05	1.011E-07	8.884E-05	1.011E-07	0.000E+00	0.000E+00	1.474E-03	1.677E-06	0.000E+00	0.000E+00
1023	0	0	2.960E-05	8.530E-08	2.960E-05	8.530E-08	0.000E+00	0.000E+00	4.911E-04	1.415E-06	0.000E+00	0.000E+00
1025	0	0	1.643E-05	1.643E-07	1.643E-05	1.643E-07	0.000E+00	0.000E+00	2.726E-04	2.726E-06	0.000E+00	0.000E+00
1027	0	0	0	0	0	0	0	0	0	0	0	0
1028	0	0	0	0	0	0	0	0	0	0	0	0
1029	0	0	1.643E-05	1.643E-07	1.643E-05	1.643E-07	0.000E+00	0.000E+00	2.726E-04	2.726E-06	0.000E+00	0.000E+00
	0	0	1.151E-03	1.643E-07	1.151E-03	1.643E-07	0.000E+00	0.000E+00	1.910E-02	2.726E-06	0.000E+00	0.000E+00
8.114E+04		9.120E+00	1.213E+01	8.430E-02	1.658E+02	1.156E+00	0.000E+00	0.000E+00	1.558E+01	9.672E-02	0.000E+00	0.000E+00
1998 TOTALS												

TABLE 1

1998 ESTIMATED

EMISSIONS

	lb/yr PAHs	lb/hr PAHs	lb/yr Propylene	lb/hr Propylene	lb/yr Selenium	lb/hr Selenium	lb/yr Toluene	lb/hr Toluene	lb/yr Xylenes	lb/hr Xylenes	lb/yr Zinc	lb/hr Zinc
1001	0	0	0	0	0.000E+00	0.000E+00	0	0	0	0	0.000E+00	0.000E+00
1002	0	0	0	0	0.000E+00	0.000E+00	0	0	0	0	0.000E+00	0.000E+00
1003	0	0	0	0	0.000E+00	0.000E+00	0	0	0	0	0.000E+00	0.000E+00
1004	0	0	0	0	0.000E+00	0.000E+00	0	0	0	0	0.000E+00	0.000E+00
1005	0	0	0	0	0.000E+00	0.000E+00	0	0	0	0	0.000E+00	0.000E+00
1006	0	0	0	0	0.000E+00	0.000E+00	0	0	0	0	0.000E+00	0.000E+00
1007	0	0	0	0	0	0	0	0	0	0	0	0
1009	0	0	0	0	0	0	0	0	0	0	0	0
1008	0	0	0	0	0	0	0	0	0	0	0	0
1010	0	0	0	0	0	0	0	0	0	0	0	0
1018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0
1021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1021A	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1025	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1027	0	0	0	0	0	0	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0
1028	0	0	0	0	0	0	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0	0
1029	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1998 TOTALS	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

TABLE 2

**RAND MINING COMPANY
RAND PROJECT ESTIMATED EMISSIONS
CANCER RISK AT ESTIMATED FACILITY LIFE**

<u>Receptor</u>	<u>X</u>	<u>Y</u>	<u>Inhalation</u>	<u>Non-Inhalation</u>	<u>Total</u>	<u>Cancer Risk 13-Year</u>
1 Randsburg	440500	3913930	6.338E-06	8.720E-06	1.506E-05	2.797E-6
2 Johannesburg	442500	3914375	4.638E-06	6.460E-06	1.110E-05	2.061E-6
3 Johannesburg School	442440	3913840	5.315E-06	7.370E-06	1.269E-05	2.357E-6
4 Red Mountain	444000	3912625	3.596E-06	5.064E-06	8.660E-06	1.608E-6
5 Dogpatch	442356	3911329	6.293E-06	6.520E-06	1.281E-05	2.379E-6

TABLE 3**RAND MINING COMPANY****TOTAL RMC FACILITY ESTIMATED EMISSIONS****CANCER RISK AT ESTIMATED FACILITY LIFE**

<u>Receptor</u>	<u>X</u>	<u>Y</u>	<u>Total</u>	<u>Cancer Risk</u> <u>16-Year</u>	<u>1992 HRA</u>	<u>Total</u> <u>Facility</u>
1 Randsburg	440500	3913930	1.506E-05	3.442E-06	3.02E-08	3.472E-06
2 Johannesburg	442500	3914375	1.110E-05	2.537E-06	3.02E-08	2.567E-06
3 Johannesburg School	442440	3913840	1.269E-05	2.901E-06	3.02E-08	2.931E-06
4 Red Mountain	444000	3912625	8.660E-06	1.979E-06	3.02E-08	2.009E-06
5 Dogpatch	442356	3911329	1.281E-05	2.928E-06	3.02E-08	2.958E-06

TABLE 4

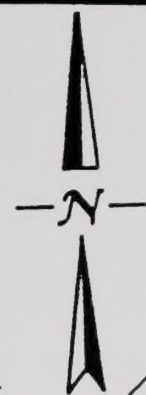
70-YEAR LIFETIME CANCER RISK BY POLLUTANT FOR RECEPTOR # 1

POLLUTANT	INHALE	DERMAL	SOIL	WATER	PLANTS	ANIMAL	MOTHER MILK	SUM
ACETA	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
As	3.137E-06	1.807E-07	8.539E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.186E-05
BENZE	3.939E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.939E-10
Be	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cd	2.975E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.975E-06
Cr	1.747E-07	5.811E-10	2.746E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.780E-07
Si	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ECHO	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb	9.713E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.713E-09
Ni	4.138E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.138E-08
PAH	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Se	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SUM	6.338E-06	1.813E-07	8.542E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.506E-05

TABLE 5

70-YEAR LIFETIME CANCER RISK BY SOURCE FOR RECEPTOR # 1

SOURCE	INHALE	DERMAL	SOIL	WATER	PLANTS	ANIMAL	MOTHER MILK	SUM
1	3.209E-08	7.109E-09	3.355E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.747E-07
2	9.925E-09	2.198E-09	1.037E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.158E-07
3	1.870E-09	4.142E-10	1.955E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.183E-08
4	8.515E-10	1.886E-10	8.902E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.942E-09
5	1.106E-06	5.891E-08	2.781E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.946E-06
6	4.173E-07	2.221E-08	1.048E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.488E-06
7	8.913E-08	4.745E-09	2.240E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.179E-07
8	5.418E-08	2.884E-09	1.361E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.932E-07
9	1.981E-06	1.159E-12	5.477E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.981E-06
10	8.246E-07	4.826E-13	2.280E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.246E-07
11	1.067E-07	6.246E-14	2.951E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.067E-07
12	6.309E-08	3.692E-14	1.744E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.309E-08
13	1.342E-12	7.536E-14	3.542E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.959E-12
14	6.084E-13	3.418E-14	1.607E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.250E-12
15	1.488E-13	8.361E-15	3.930E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.502E-13
16	1.466E-13	8.235E-15	3.871E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.419E-13
17	1.342E-12	7.536E-14	3.542E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.959E-12
18	1.356E-12	7.613E-14	3.579E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.011E-12
19	3.550E-14	1.995E-15	9.376E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.313E-13
20	3.453E-14	1.939E-15	9.114E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.276E-13
21	7.229E-14	4.060E-15	1.908E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.672E-13
22	1.073E-13	6.024E-15	2.831E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.964E-13
23	3.515E-14	1.975E-15	9.282E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.299E-13
24	3.478E-14	1.954E-15	9.184E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.286E-13
25	8.443E-14	4.743E-15	2.230E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.122E-13
26	4.482E-08	1.677E-09	7.920E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.257E-07
27	1.527E-08	5.714E-10	2.699E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.283E-08
28	5.699E-08	1.921E-09	9.031E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.492E-07
29	8.474E-08	2.857E-09	1.343E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.219E-07
30	1.211E-09	4.082E-11	1.919E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.171E-09
31	9.925E-10	3.345E-11	1.572E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.598E-09
32	3.262E-07	1.704E-08	8.008E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.144E-06
33	4.877E-07	2.547E-08	1.197E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.710E-06
34	6.068E-07	3.169E-08	1.489E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.127E-06
35	1.458E-08	7.614E-10	3.579E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.113E-08
36	1.122E-08	5.861E-10	2.755E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.936E-08
37	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
38	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
39	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
40	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
41	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
42	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
43	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
44	3.581E-10	1.418E-13	6.699E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.589E-10
45	8.650E-11	1.112E-15	5.253E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.655E-11
46	1.039E-10	1.336E-15	6.313E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.040E-10
47	1.026E-11	1.318E-16	6.228E-15	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.027E-11
48	1.134E-11	1.458E-16	6.890E-15	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.135E-11
49	7.104E-12	9.131E-17	4.315E-15	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.108E-12
50	4.336E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.336E-13
51	7.931E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.931E-11
52	3.620E-12	4.653E-17	2.199E-15	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.622E-12
53	1.050E-10	1.350E-15	6.379E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.051E-10
SUM	6.338E-06	1.813E-07	8.541E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.506E-05



RANDSBURG REDROCK ROAD

US 99

RANDSBURG

JOHANNESBURG

RED MOUNTAIN

TR 123

US 99

DOOPATON

RANDSBURG MOJAVE ROAD

US 99

0 4000' 8000'

SCALE IN FEET



WZI INC.
BAKERSFIELD, CALIFORNIA

RAND MINING COMPANY
PROJECT LOCATION MAP

DATE 11/93

1818.0070

FIGURE 1



APPENDIX I

CO STARTING
 CO TITLEONE RAND MINING COMPANY - AIR QUALITY ASSESSMENT
 CO TITLETWO - 1998 ESTIMATED EMISSIONS - PM10 - Revised 4/95
 CO DELOPT DFAULT CONC RURAL
 CO AVERTIME PERIOD 24
 CO POLLUTID OTHER
 CO TERREHGS ELEV
 CO FLAGPOLE 1.8
 CO DCAYCOEF .000000
 CO RUNORNOT RUN
 CO ERRORFIL G:ACE2RNDRAND.ERR
 CO FINISHED

SO STARTING

** Source Location Cards:

** SRCID	SRC TYP	XS	YS	ZS
SO LOCATION DRLG_YA1	AREA	439410	3912644	.0000
SO LOCATION DRLG_YA2	AREA	439828	3912399	.0000
SO LOCATION DRLG_LA1	AREA	440758	3911585	.0000
SO LOCATION DRLG_LA2	AREA	441285	3911600	.0000
SO LOCATION BLST_YA1	VOLUME	439622	3912781	.0000
SO LOCATION BLST_YA2	VOLUME	440030	3912682	.0000
SO LOCATION BLST_LA1	VOLUME	441008	3911711	.0000
SO LOCATION BLST_LA2	VOLUME	441382	3911755	.0000
SO LOCATION TRK_YA1	VOLUME	439622	3912781	.0000
SO LOCATION TRK_YA2	VOLUME	440030	3912682	.0000
SO LOCATION TRK_LA1	VOLUME	441008	3911711	.0000
SO LOCATION TRK_LA2	VOLUME	441382	3911755	.0000
SO LOCATION HAU_YAO_1	AREA	439385	3912919	.0000
SO LOCATION HAU_YAO_2	AREA	439745	3912588	.0000
SO LOCATION HAU_YAO_3	AREA	440321	3911947	.0000
SO LOCATION HAU_YAO_4	AREA	439884	3911305	.0000
SO LOCATION HAU_YAW_1	AREA	439385	3912919	.0000
SO LOCATION HAU_YAW_2	AREA	439300	3913202	.0000
SO LOCATION HAULAO_1	AREA	441160	3911686	.0000
SO LOCATION HAULAO_2	AREA	441170	3911469	.0000
SO LOCATION HAULAO_3	AREA	440566	3911186	.0000
SO LOCATION HAULAO_4	AREA	439961	3910994	.0000
SO LOCATION HAULAW_1	AREA	441160	3911469	.0000
SO LOCATION HAULAW_2	AREA	441330	3911884	.0000
SO LOCATION HAULAW_3	AREA	440848	3911843	.0000
SO LOCATION DZGYAOR	VOLUME	439800	3911247	.0000
SO LOCATION DZGLAOR	VOLUME	439973	3911012	.0000
SO LOCATION DGYAWST1	VOLUME	438928	3913505	.0000
SO LOCATION DGYAWST2	VOLUME	439235	3913182	.0000
SO LOCATION DGLAWST1	VOLUME	441039	3912045	.0000
SO LOCATION DGLAWST2	VOLUME	441495	3912139	.0000
SO LOCATION EROSION1	AREA	438700	3913268	.0000
SO LOCATION EROSION2	AREA	439012	3912915	.0000
SO LOCATION EROSION3	AREA	439693	3912978	.0000
SO LOCATION EROSION4	AREA	440828	3911856	.0000
SO LOCATION EROSION5	AREA	441282	3911905	.0000

** Source Parameter Cards:

** POINT:	SRCID	QS	HS	TS	VS	DS
** VOLUME:	SRCID	QS	HS	SYINIT	SZINIT	
** AREA:	SRCID	QS	HS	XINIT		
SO SRCPARAM DRLG_YA1	2.562E-08	2.0000	468.00			
SO SRCPARAM DRLG_YA2	2.562E-08	2.0000	468.00			
SO SRCPARAM DRLG_LA1	6.985E-08	2.0000	298.00			
SO SRCPARAM DRLG_LA2	6.985E-08	2.0000	298.00			
SO SRCPARAM BLST_YA1	1.262E-00	50.0000	108.842		23.256	
SO SRCPARAM BLST_YA2	1.262E-00	50.0000	108.842		23.256	
SO SRCPARAM BLST_LA1	1.406E-00	50.0000	69.296		23.256	
SO SRCPARAM BLST_LA2	1.406E-00	50.0000	69.296		23.256	
SO SRCPARAM TRK_YA1	1.660E-01	8.0000	108.842		3.721	
SO SRCPARAM TRK_YA2	1.660E-01	8.0000	108.842		3.721	
SO SRCPARAM TRK_LA1	1.83E-01	8.0000	69.296		3.721	
SO SRCPARAM TRK_LA2	1.83E-01	8.0000	69.296		3.721	
SO SRCPARAM HAU_YAO_1	1.025E-06	2.0000	129.00			
SO SRCPARAM HAU_YAO_2	1.025E-06	2.0000	157.00			
SO SRCPARAM HAU_YAO_3	1.025E-06	2.0000	157.00			
SO SRCPARAM HAU_YAO_4	1.025E-06	2.0000	157.00			
SO SRCPARAM HAU_YAW_1	1.025E-06	2.0000	129.00			
SO SRCPARAM HAU_YAW_2	1.025E-06	2.0000	129.00			
SO SRCPARAM HAULAO_1	1.025E-06	2.0000	125.00			
SO SRCPARAM HAULAO_2	1.025E-06	2.0000	136.00			
SO SRCPARAM HAULAO_3	1.025E-06	2.0000	136.00			
SO SRCPARAM HAULAO_4	1.025E-06	2.0000	136.00			

SO	SRCPARAM	HAULAW_1	1.025E-06	2.0000	125.00	
SO	SRCPARAM	HAULAW_2	1.025E-06	2.0000	125.00	
SO	SRCPARAM	HAULAW_3	1.025E-06	2.0000	125.00	
SO	SRCPARAM	DZGYAOR	3.17E-02	6.0000	88.79	2.791
SO	SRCPARAM	DZGLAOR	1.52E-02	6.0000	88.79	2.791
SO	SRCPARAM	DGYAWST1	7.20E-02	6.0000	106.903	2.791
SO	SRCPARAM	DGYAWST2	7.20E-02	6.0000	106.903	2.791
SO	SRCPARAM	DGLAWST1	2.368E-02	6.0000	86.934	2.791
SO	SRCPARAM	DGLAWST2	2.368E-02	6.0000	86.934	2.791
SO	SRCPARAM	EROSION1	1.977E-06	0.0000	460.00	
SO	SRCPARAM	EROSION2	1.977E-06	0.0000	460.00	
SO	SRCPARAM	EROSION3	1.977E-06	0.0000	405.00	
SO	SRCPARAM	EROSION4	1.977E-06	0.0000	374.00	
SO	SRCPARAM	EROSION5	1.977E-06	0.0000	374.00	

SO EMISUNIT .100000E+07 (GRAMS/SEC) (MICROGRAMS/CUBIC-METER)
 SO SRCGROUP ALL
 SO FINISHED

RE STARTING
 RE DISCCART 394000 3953000 1.8
 RE DISCCART 492000 3972000 1.8
 RE DISCCART 440500 3913930 1.8
 RE DISCCART 442500 3914375 1.8
 RE DISCCART 442440 3913840 1.8
 RE DISCCART 444000 3912625 1.8
 RE DISCCART 442356 3911329 1.8
 RE DISCCART 445400 3914000 1.8
 RE DISCCART 447100 3916850 1.8
 RE FINISHED

ME STARTING
 ME INPUTFIL G:\METDATA\EDW\EDW69M.ASC
 ME ANEMHGHT 10.000 METERS
 ME SURFDATA 23114 1969 SURFNAME
 ME UAIRDATA 23114 1969 UAIRNAME
 ME WINDCATS 1.54 3.09 5.14 8.23 10.80
 ME STARTEND 69 01 01 69 12 31
 ME FINISHED

OU STARTING
 OU RECTABLE 24 FIRST
 OU FINISHED

BEE-Line BEEST-X Version 2.01

Input File - RND\PM1R.DTA
 Output File - RND\PM1R.LST
 Met File - G:\METDATA\EDW\EDW69M.AS

*** Message Summary For ISC2 Model Setup ***

----- Summary of Total Messages -----

A Total of 0 Fatal Error Message(s)
 A Total of 9 Warning Message(s)
 A Total of 0 Informational Message(s)

***** FATAL ERROR MESSAGES *****
 *** NONE ***

***** WARNING MESSAGES *****
 RE W228 106 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
 RE W228 107 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
 RE W228 108 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
 RE W228 109 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
 RE W228 110 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
 RE W228 111 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
 RE W228 112 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
 RE W228 113 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
 RE W228 114 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART

 *** SETUP Finishes Successfully ***

MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

*** MODEL SETUP OPTIONS SUMMARY ***

**Model Is Setup For Calculation of Average CONCentration Values.

**Model Uses RURAL Dispersion.

**Model Uses Regulatory DEFAULT Options:

1. Final Plume Rise.
2. Stack-tip Downwash.
3. Buoyancy-induced Dispersion.
4. Use Calms Processing Routine.
5. Not Use Missing Data Processing Routine.
6. Default Wind Profile Exponents.
7. Default Vertical Potential Temperature Gradients.
8. "Upper Bound" Values for Supersquat Buildings.
9. No Exponential Decay for RURAL Mode

**Model Uses EPA Intermediate Terrain Policy - COMPLEX-I Regulatory Default Options

1. IOPT(1)=1, Use Terrain Adjustments
2. IOPT(3)=0, Use Gradual Plume Rise
3. IOPT(4)=1, Use BID
4. IOPT(25)=1 Complex Terrain Option
5. ZMIN=10.0 Meters
6. CONTE=0.5 for Stability A thru D, 0 for E & F

**Model Accepts Receptors on ELEV Terrain.

**Model Accepts FLAGPOLE Receptor Heights.

**Model Calculates 1 Short Term Average(s) of: 24-HR
and Calculates PERIOD Averages

is Run Includes: 36 Source(s); 1 Source Group(s); and 9 Receptor(s)

**The Model Assumes A Pollutant Type of: OTHER

**Model Set To Continue RUNning After the Setup Testing.

**Output Options Selected:

Model Outputs Tables of PERIOD Averages by Receptor
Model Outputs Tables of Highest Short Term Values by Receptor (RECTABLE Keyword)

**NOTE: The Following Flags May Appear Following CONC Values: c for Calm Hours
m for Missing Hours
b for Both Calm and Missing Hours

**Misc. Inputs: Anem. Hgt. (m) = 10.00 ; Decay Coef. = 0.0000 ; Rot. Angle = 0.0
Emission Units = (GRAMS/SEC) ; Emission Rate Unit Factor = 0.10000E+07
Output Units = (MICROGRAMS/CUBIC-METER)

**Input Runstream File: RND@PM1R.DTA ; **Output Print File: RND@PM1R.LST

**Detailed Error/Message File: G:@ACE2@RND@RAND.ERR

*** MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

*** VOLUME SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (USER UNITS)	X (METERS)	Y (METERS)	BASE ELEV. (METERS)	RELEASE HEIGHT (METERS)	INIT. SY (METERS)	INIT. SZ (METERS)	EMISSION RATE SCALAR VARY BY
BLST_YA1	0	0.12620E+01	439622.0	3912781.0	0.0	50.00	108.84	23.26	
ST_YA2	0	0.12620E+01	440030.0	3912682.0	0.0	50.00	108.84	23.26	
ST_LA1	0	0.14060E+01	441008.0	3911711.0	0.0	50.00	69.30	23.26	
BLST_LA2	0	0.14060E+01	441382.0	3911755.0	0.0	50.00	69.30	23.26	
TRK_YA1	0	0.16600E+00	439622.0	3912781.0	0.0	8.00	108.84	3.72	
TRK_YA2	0	0.16600E+00	440030.0	3912682.0	0.0	8.00	108.84	3.72	
TRK_LA1	0	0.18300E+00	441008.0	3911711.0	0.0	8.00	69.30	3.72	
TRK_LA2	0	0.18300E+00	441382.0	3911755.0	0.0	8.00	69.30	3.72	
DZGYAOR	0	0.31700E-01	439800.0	3911247.0	0.0	6.00	88.79	2.79	

DZGLAOR	0	0.15200E-01	439973.0	3911012.0	0.0	6.00	88.79	2.79
DGYAWST1	0	0.72000E-01	438928.0	3913505.0	0.0	6.00	106.90	2.79
DGYAWST2	0	0.72000E-01	439235.0	3913182.0	0.0	6.00	106.90	2.79
DGLAWST1	0	0.23680E-01	441039.0	3912045.0	0.0	6.00	86.93	2.79
DGLAWST2	0	0.23680E-01	441495.0	3912139.0	0.0	6.00	86.93	2.79

ISCST2 (BEEST-X) - VERSION 93109 *** *** RAND MINING COMPANY - AIR QUALITY ASSESSMENT
*** - 1998 ESTIMATED EMISSIONS - PM10 - Revised 4/95

*** 04/12/95
15:29:26
PAGE 3

*** MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

*** AREA SOURCE DATA ***

SOURCE ID	PART. CATS.	EMISSION RATE (USER UNITS /METER**2)	COORD (SW CORNER) X (METERS)	Y (METERS)	BASE ELEV. (METERS)	RELEASE HEIGHT (METERS)	WIDTH OF AREA (METERS)	EMISSION RATE SCALAR VARY BY
DRLG_YA1	0	0.25620E-07	439410.0	3912644.0	0.0	2.00	468.00	
DRLG_YA2	0	0.25620E-07	439828.0	3912399.0	0.0	2.00	468.00	
DRLG_LA1	0	0.69850E-07	440758.0	3911585.0	0.0	2.00	298.00	
DRLG_LA2	0	0.69850E-07	441285.0	3911600.0	0.0	2.00	298.00	
HAUYAO_1	0	0.10250E-05	439385.0	3912919.0	0.0	2.00	129.00	
HAUYAO_2	0	0.10250E-05	439745.0	3912588.0	0.0	2.00	157.00	
HAUYAO_3	0	0.10250E-05	440321.0	3911947.0	0.0	2.00	157.00	
HAUYAO_4	0	0.10250E-05	439884.0	3911305.0	0.0	2.00	157.00	
HAUYAW_1	0	0.10250E-05	439385.0	3912919.0	0.0	2.00	129.00	
HAUYAW_2	0	0.10250E-05	439300.0	3913202.0	0.0	2.00	129.00	
HAULAO_1	0	0.10250E-05	441160.0	3911686.0	0.0	2.00	125.00	
HAULAO_2	0	0.10250E-05	441170.0	3911469.0	0.0	2.00	136.00	
HAULAO_3	0	0.10250E-05	440566.0	3911186.0	0.0	2.00	136.00	
HAULAO_4	0	0.10250E-05	439961.0	3910994.0	0.0	2.00	136.00	
HAULAW_1	0	0.10250E-05	441160.0	3911469.0	0.0	2.00	125.00	
HAULAW_2	0	0.10250E-05	441330.0	3911884.0	0.0	2.00	125.00	
HAULAW_3	0	0.10250E-05	440848.0	3911843.0	0.0	2.00	125.00	
EROSION1	0	0.19770E-05	438700.0	3913268.0	0.0	0.00	460.00	
EROSION2	0	0.19770E-05	439012.0	3912915.0	0.0	0.00	460.00	
EROSION3	0	0.19770E-05	439693.0	3912978.0	0.0	0.00	405.00	
EROSION4	0	0.19770E-05	440828.0	3911856.0	0.0	0.00	374.00	
EROSION5	0	0.19770E-05	441282.0	3911905.0	0.0	0.00	374.00	

ISCST2 (BEEST-X) - VERSION 93109 *** *** RAND MINING COMPANY - AIR QUALITY ASSESSMENT
*** - 1998 ESTIMATED EMISSIONS - PM10 - Revised 4/95

*** 04/12/95
15:29:26
PAGE 4

*** MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

*** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID	SOURCE IDs
ALL	DRLG_YA1, DRLG_YA2, DRLG_LA1, DRLG_LA2, BLST_YA1, BLST_YA2, BLST_LA1, BLST_LA2, TRK_YA1, TRK_YA2, TRK_LA1, TRK_LA2, HAUYAO_1, HAUYAO_2, HAUYAO_3, HAUYAO_4, HAUYAW_1, HAUYAW_2, HAULAO_1, HAULAO_2, HAULAO_3, HAULAO_4, HAULAW_1, HAULAW_2, HAULAW_3, DZGYAOR, DZGLAOR, DGYAWST1, DGYAWST2, DGLAWST1, DGLAWST2, EROSION1, EROSION2, EROSION3, EROSION4, EROSION5,

ISCST2 (BEEST-X) - VERSION 93109 *** *** RAND MINING COMPANY - AIR QUALITY ASSESSMENT
*** - 1998 ESTIMATED EMISSIONS - PM10 - Revised 4/95

*** 04/12/95
15:29:26
PAGE 5

*** MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(394000.0, 3953000.0,	1.8,	1.8);	(492000.0, 3972000.0,	1.8,	1.8);
(440500.0, 3913930.0,	1.8,	1.8);	(442500.0, 3914375.0,	1.8,	1.8);
(442440.0, 3913840.0,	1.8,	1.8);	(444000.0, 3912625.0,	1.8,	1.8);
(442356.0, 3911329.0,	1.8,	1.8);	(445400.0, 3914000.0,	1.8,	1.8);
(447100.0, 3916850.0,	1.8,	1.8);			

ISCST2 (BEEST-X) - VERSION 93109 *** *** RAND MINING COMPANY - AIR QUALITY ASSESSMENT
*** - 1998 ESTIMATED EMISSIONS - PM10 - Revised 4/95

*** 04/12/95
15:29:26
PAGE 6

*** MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

[illegible]

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

1.54, 3.09, 5.14, 8.23, 10.80,

STABILITY CATEGORY	WIND SPEED CATEGORY					
	1	2	3	4	5	6
A	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
B	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
C	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00
D	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00
E	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00
F	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00

STABILITY CATEGORY	WIND SPEED CATEGORY					
	1	2	3	4	5	6
A	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
B	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
C	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
D	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
E	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01
F	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01

*** 04/12/95
 *** 15:29:26
 PAGE 7

*** THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

FORMAT: (4I2,2F9.4,F6.1,I2,2F7.1)
 UPPER AIR STATION NO.: 23114
 NAME: UAIRNAME
 YEAR: 1969

YEAR	MONTH	DAY	HOUR	FLOW	SPEED	TEMP	STAB	MIXING HEIGHT (M)	
				VECTOR	(M/S)	(K)	CLASS	RURAL	URBAN
69	1	1	1	81.0	1.54	273.1	6	1040.0	410.0
69	1	1	2	128.0	2.06	272.0	5	1040.0	410.0
69	1	1	3	124.0	1.54	270.9	6	1040.0	410.0
69	1	1	4	123.0	0.00	271.5	6	1040.0	410.0
69	1	1	5	123.0	0.00	270.4	6	1040.0	410.0
69	1	1	6	122.0	0.00	269.8	7	1040.0	410.0
69	1	1	7	135.0	1.03	269.3	6	313.0	424.0
69	1	1	8	133.0	0.00	272.0	5	313.0	512.0
69	1	1	9	127.0	0.00	274.8	4	313.0	600.0
69	1	1	10	51.0	1.03	277.0	3	459.0	688.0
69	1	1	11	84.0	1.54	281.5	3	604.0	776.0
69	1	1	12	76.0	0.00	283.7	3	749.0	864.0
69	1	1	13	83.0	0.00	284.3	3	895.0	952.0
69	1	1	14	79.0	0.00	285.4	3	1040.0	1040.0
69	1	1	15	82.0	0.00	285.9	3	1040.0	1040.0

69	1	1	16	84.0	0.00	286.5	3	1040.0	1040.0
69	1	1	17	81.0	0.00	284.8	4	1040.0	1040.0
69	1	1	18	147.0	1.03	279.8	5	1040.0	917.0
69	1	1	19	154.0	0.00	277.6	6	1040.0	833.0
69	1	1	20	197.0	2.06	275.4	5	1040.0	748.0
69	1	1	21	130.0	2.06	275.4	5	1040.0	664.0
69	1	1	22	92.0	1.03	274.3	6	1040.0	579.0
69	1	1	23	110.0	2.06	272.6	6	1040.0	495.0
69	1	1	24	110.0	2.06	271.5	6	1040.0	410.0

*** NOTES: STABILITY CLASS 1=A, 2=B, 3=C, 4=D, 5=E AND 6=F.
FLOW VECTOR IS DIRECTION TOWARD WHICH WIND IS BLOWING.

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*** 04/12/95
*** 15:29:26
*** PAGE 8

*** MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

*** THE PERIOD (8760 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): DRLG_YA1, DRLG_YA2, DRLG_LA1, DRLG_LA2, BLST_YA1, BLST_YA2, BLST_LA1,
BLST_LA2, TRK_YA1, TRK_YA2, TRK_LA1, TRK_LA2, HAUYAO_1, HAUYAO_2, HAUYAO_3, HAUYAO_4, HAUYAW_1, HAUYAW_2, HAULAO_1,
HAULAO_2, HAULAO_3, HAULAO_4, HAULAW_1, HAULAW_2, HAULAW_3, DZGYAOR, DZGLAOR, DGYAWST1, DGYAWST2, DGLAWST1, . . . ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN (MICROGRAMS/CUBIC-METER) **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
394000.00	3953000.00	0.00394	492000.00	3972000.00	0.04626
440500.00	3913930.00	5.90354	442500.00	3914375.00	2.99761
442440.00	3913840.00	3.55081	444000.00	3912625.00	2.21405
442356.00	3911329.00	3.51103	445400.00	3914000.00	1.72273
447100.00	3916850.00	1.15023			

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*** 04/12/95
*** 15:29:26
*** PAGE 9

MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

*** THE 1ST HIGHEST 24-HR AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): DRLG_YA1, DRLG_YA2, DRLG_LA1, DRLG_LA2, BLST_YA1, BLST_YA2, BLST_LA1,
BLST_LA2, TRK_YA1, TRK_YA2, TRK_LA1, TRK_LA2, HAUYAO_1, HAUYAO_2, HAUYAO_3, HAUYAO_4, HAUYAW_1, HAUYAW_2, HAULAO_1,
HAULAO_2, HAULAO_3, HAULAO_4, HAULAW_1, HAULAW_2, HAULAW_3, DZGYAOR, DZGLAOR, DGYAWST1, DGYAWST2, DGLAWST1, . . . ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN (MICROGRAMS/CUBIC-METER) **

X-COORD (M)	Y-COORD (M)	CONC	(YYMMDDHH)	X-COORD (M)	Y-COORD (M)	CONC	(YYMMDDHH)
394000.00	3953000.00	0.56878c	(69100424)	492000.00	3972000.00	0.53599c	(69013124)
440500.00	3913930.00	17.88503c	(69013124)	442500.00	3914375.00	11.39875c	(69082024)
442440.00	3913840.00	11.88178c	(69040824)	444000.00	3912625.00	10.62245c	(69040824)
442356.00	3911329.00	31.28317c	(69100524)	445400.00	3914000.00	9.20034c	(69102424)
447100.00	3916850.00	4.44748c	(69070124)				

ISCST2 (BEEST-X) - VERSION 93109 *** RAND MINING COMPANY - AIR QUALITY ASSESSMENT
*** - 1998 ESTIMATED EMISSIONS - PM10 - Revised 4/95

*** 04/12/95
*** 15:29:26
*** PAGE 10

*** MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (8760 HRS) RESULTS ***

** CONC OF OTHER IN (MICROGRAMS/CUBIC-METER) **

GROUP ID	AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
ALL	1ST HIGHEST VALUE IS	5.90354 AT (440500.00, 3913930.00,	1.80, 1.80)	DC
	2ND HIGHEST VALUE IS	3.55081 AT (442440.00, 3913840.00,	1.80, 1.80)	DC
	3RD HIGHEST VALUE IS	3.51103 AT (442356.00, 3911329.00,	1.80, 1.80)	DC
	4TH HIGHEST VALUE IS	2.99761 AT (442500.00, 3914375.00,	1.80, 1.80)	DC
	5TH HIGHEST VALUE IS	2.21405 AT (444000.00, 3912625.00,	1.80, 1.80)	DC
	6TH HIGHEST VALUE IS	1.72273 AT (445400.00, 3914000.00,	1.80, 1.80)	DC

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR

DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

ISC2 (BEEST-X) - VERSION 93109 *** *** RAND MINING COMPANY - AIR QUALITY ASSESSMENT
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*** 04/12/95
15:29:26
PAGE 11

*** MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***

** CONC OF OTHER IN (MICROGRAMS/CUBIC-METER) **

GROUP ID	AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
ALL	HIGH 1ST HIGH VALUE IS	31.28317c ON 69100524: AT (	442356.00, 3911329.00,	1.80,	1.80) DC

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

ISCST2 (BEEST-X) - VERSION 93109 *** *** RAND MINING COMPANY - AIR QUALITY ASSESSMENT
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*** 04/12/95
15:29:26
PAGE 12

*** MODELING OPTIONS USED: CONC RURAL INTR FLGPOL DFAULT

*** Message Summary For ISC2 Model Execution ***

----- Summary of Total Messages -----

A Total of 0 Fatal Error Message(s)
A Total of 9 Warning Message(s)
Total of 1747 Informational Message(s)
A Total of 1747 Calm Hours Identified

***** FATAL ERROR MESSAGES *****
*** NONE ***

***** WARNING MESSAGES *****
RE W228 106 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
RE W228 107 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
RE W228 108 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
RE W228 109 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
RE W228 110 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
RE W228 111 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
RE W228 112 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
RE W228 113 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART
RE W228 114 DISCAR: Default(s) Used for Missing Parameters on Keyword DISCCART

*** ISCST2 Finishes Successfully ***

APPENDIX G

**Sensitive Floral Species Survey, Vegetation
Resources and Baseline Data Assessment, Rand Project,
Kern County, California**

RECEIVED

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EMA, INC. - RENO

SENSITIVE FLORAL SPECIES SURVEY

VEGETATION RESOURCES
&
BASELINE DATA ASSESSMENT

RAND PROJECT
KERN COUNTY, CALIFORNIA

Prepared for:
Rand Mining Company
Randsburg, California

Prepared by:

RICHARD A. DODGE, PhD
c/o SASS, 114 Balsam Street
P.O. Box 1707
Ridgecrest, CA 93555
619 375 1003
FAX 619 375 4228
June 24, 1993

INTRODUCTION

In conformance with Bureau of Land Management (BLM) regulations, 43 CFR 3800, Rand Mining Company (Rand) submitted a Plan of Operations (POO) for Rand's proposal to develop the Rand Project, an expansion of Rand's existing open pit gold and silver mine and heap leach recovery operations located on public and private lands south of the town of Randsburg in Kern County, California. Ore and waste would be mined from the three (3) existing open pits plus associated satellite deposits.

The project area is located in eastern Kern County, approximately 40 miles northeast of Mojave, 30 miles south of Ridgecrest and 1 mile south of Randsburg. The existing operations, as well as the proposed project, are located within Sections 34 and 35, Township 29 South, Range 40 East, Sections 1, 2, 3, 10, 11, and 12, Township 30 South, Range 40 East, Mount Diablo Baseline & Meridian (MDB&M).

The Project boundary and location of the existing mining facilities are shown in Figure 1 (EMA Fig 4 Drawing No. 0612-003) and the locations of the proposed expansion facilities are shown in Figure 2 (EMA Fig 5 Drawing No. 0612-005). The Proposed Surface Disturbance Acreage for the several mine facility components is listed in Table 1 with the pertinent report of biological surveys already completed and cited.

Table 1: Proposed Surface Disturbance Acreage for the Rand Project

Mine Facility Component	Acres	Biol. Survey	Acres
Yellow Aster Pit Extension	70	Brown 1988	75
Baltic Pit Extension	20	McMains 1987	200
Lamont Pit Extension	20	McMains 1987	*
Satellite Pit	30	Gould 1989	51
Lamont Valley Waste Rock Stockpile	170	Current Report	-
West Valley Waste Rock Stockpile	260	LaPre 1992	45
West Valley Topsoil Stockpile	20	LaPre 1992	*
Lamont Valley Leach Pad	270	Current Report	-
Lamont Valley Plant Site	20	Current Report	-
Descarga Area Leach Pad	60	Current Report	-
Descarga Area Plant Site	10	Current Report	-
Baltic Waste Rock Stockpile	30	Dodge 1993	502
Lamont Valley Topsoil Stockpile	20	Current Report	-
Haul and Exploration Roads	20	Composite	*

* Previously reported

This report has been prepared as a technical appendix for the application. The biological resources of the study areas are described from information previously acquired (McMains 1987, Brown, 1988, Gould 1989, LaPre 1992 and Dodge 1993), as well as Spring 1993 reconnaissance, on site vegetation surveys and plant collections.

Figure 3 identifies the study areas of previous investigators and the areas studied in this current report (Dodge, 1993).

SUMMARY OF SURVEYS

There have been at least five previous biological surveys and/or baseline studies in and around the Rand Project. These surveys include the nucleus of the Project and represent the basis for the most current field surveys reported herein.

Current studies concentrated on the areas, notably in the Lamont Valley, which were not previously analyzed. Other sites encompassed within the Rand Project were visited several times during the Spring 1993 for the purpose of verifying, expanding and extending the already existing compendium of plants. Spring 1993 has been a most fortuitous period for this study because most of the perennial vegetation, as well as, many annuals were in profuse bloom and set seed due to the heavy rainfall experienced during the 1992/93 winter/spring.

Previous studies identified include the following:

1. No Nains, J.E. 1987: Biological Resources Survey, Echo Bau Mining Company, Randburg Project, Rand Mountains, California.

Location: 200 acre study area located in portions of Sections 1 and 12, T30S,R40E, MDBM.

Facilities: Survey done for the proposed Echo Bau project. Area now includes portions of the Baltic pit, Baltic waste dump processing plant and project roads, and the Lamont pit. It will include a portion of the Baltic pit extension, and new access road, and the Lamont pit extension.

Purpose: Survey for the identification and description of the biological resources of the area.

Methods: Foot and vehicle survey.

Results: Creosote bush scrub community. No sensitive, threatened or endangered species identified.

2. Brown, P., 1988: A Biological Survey of Parcel Map 182-100-031, Kern County, Conducted for Rand Mining Company, California.

Location: 75 acres in NW 1/4 of Section 2, T30S,R40E,MDBM.

Facilities: Proposed expansion of the Yellow Aster Mine, or waste dumps or leach pads in 1988; presently Yellow Aster pit, dump, and Heap leach in this area; 1993 proposed expansion of Yellow Aster pit in this area.

Purpose: Documentation of vegetation and wildlife present.

Methods: Conducted 8/26 - 8/28, walking a grid at 15 meter intervals.

Results: Creosote Bush Scrub community identified. Creosote bush and blackbrush dominant. Some Joshua Trees observed along with cholla and beavertail cactus, no sensitive, threatened or endangered plant species found.

3. Gould, P.E., 1989: Biological Resources Survey, Yellow Aster Mine Rand Mining Company, Randsburg, California.

Location: 51 acres in central portion, Section 2, R30S, R40E, MDBM.

Facilities: Area of proposed Yellow Aster leach pad in 1989; currently Yellow Aster heap leach. Will possibly include new portion of Satellite pit.

Purpose: Survey for the presence or absence of sensitive biotic resources.

Methods: Reconnaissance field survey conducted 4/23/89, 4/29/89 and 4/30/89; included vehicle survey of the area, and walking 20 foot interval transects, covering the area of the proposed leach pad, with emphasis on the desert tortoise and other sensitive species.

Results: Blackbrush Scrub identified. Blackbrush and creosote bush dominant. No sensitive, threatened or endangered floral species found. Some Joshua trees present.

4. LaPre, L.F., 1992: Randsburg Flagstone Biological Assessment, Randsburg Flagstone, Pruett Desert Supply, Randsburg, CA.

Location: 45 acre mining claim and rock quarry adjacent to and possibly part of the West Valley Waste Rock Stockpile Area, SE 1/4 of the SE 1/4 of Section 34, T29S, R40E, MDBM.

Purpose: Baseline study for consideration of a reclamation plan to mitigate the impacts of the mining of building materials.

Methods: Literature review to identify any sensitive elements including consultation with the California Natural Diversity Data Base. Field survey on 4/26/92 walking the site, collecting specimens of plant materials and photographing the major biological features.

Results: Creosote bush scrub plant community, dominated by creosote bush, burrobush, Krameria, and bladder sage. Joshua trees were observed on the hillsides and one cottontop cactus was found.

5. Dodge, R.A., 1993: Vegetation Resources, Baseline Studies and Reclamation Recommendations, Baltic Mine Project, Kern County California, Rand Mining Company, Randsburg, CA.

Location: 532 acre project area for an open-pit gold and silver mine and heap leach recovery operation, 1.5 miles south of Randsburg and encompassing portions of Sections 1, 2, 11, and 12, T30S, R40E, MDBM.

Purpose: Establish four (4) 1 meter square - 16 meter square quadrats (plots) to provide a density value of the perennial herbaceous and shrub species to evaluate revegetation success.

Methods: Four (4) sample plots were established (nested 1 meter square - 16 meter square) for floral density sampling. One (1)

sample site was located on a representative portion of the leach pad and one (1) was located on a representative portion of the waste rock stockpile. The two (2) remaining plots were located in areas adjacent to the project facilities which are not anticipated to be disturbed. The area surrounding each quadrat was sampled by walking in an increasing spiral outward from the quadrat to identify species which were not found within the study plot, but were in the vicinity.

The remaining areas which were not subjected to floral density analysis were surveyed by foot and vehicle.

Results: Creosote bush scrub community is the typical vegetation for this region. While not as plentiful as other perennials, creosote bush is considered dominant because of its stature, longevity and widespread occurrence. Other perennial species, such as, Mormon tea, burrobrush and blackbrush are often more common than creosote bush.

No sensitive, threatened or endangered plant species were found. Joshua trees were found on the upland sites. No cactus specimens were found in this area possibly due to heavy collection pressures and offroad vehicle activity.

Previous reports, cited above, have studied in detail approximately 50% of the Rand Project Components. All of the components previously studied have been revisited and where possible overviewed, and to the extent possible, the results rechecked.

The Lamont Valley waste Rock Stockpile, the West Valley Waste Rock Stockpile, the West Valley Topsoil Stockpile, and the Lamont Valley Leach Pad, which are basically unstudied previously, are the primary focus of this report.

METHODS

A literature/report review was undertaken to become familiar with the several sites, and to become familiar with the expected vegetation/flora to be encountered. Field surveys/reconnaissance visits were started in early March 1983. In all of these visits students, and student assistants were included in the surveys.

The surveys were driving/walking events which usually resulted in collections, field identification and photographic records. Students were encouraged to make collections of material unknown to them for later identification in the laboratory. Collections have been made over the four month period from March to June. Collection permits were acquired through the Bureau of Land Management (BLM) and specimens are being mounted and prepared for deposit with the Ridgecrest area office of the BLM.

Because of the excellent winter/spring precipitation, many specimens have been collected in flower and fruit for preservation. The observed flora were cross checked with previous floral compendia for reference. Specimens of cactus and Joshua tree were photographed and other species which had been previously observed noted.

Figure 4 maps the driving and walking routes in the region of the

several components of the Rand Project. Appendix I (Field Log) indicates the date, personnel (in addition to myself), location, activity and number of hours devoted to the event. There have thus far been forty (40) hours devoted in the field for the Rand Project. Additional hours spent in the classroom and laboratory by students and their instructor have not been charged to the project. This field activity has been used as a hands-on case study for students enrolled in Environmental Science at Cerro Coso Community College, Ridgecrest, California.

RESULTS

Conclusions contained herein are from the previous reports already cited in table 1. All sites listed have been visited during the Spring 1993 season and where possible the previous results verified in the field. In addition to the above cited studies within the several components of this project, the following extension studies have been undertaken during the Spring 1993 season. This has been a fortuitous time to undertake these investigations because of the ample rainfall during the 1992/93 winter and spring period.

Yellow Aster Pit Extension (70 acre) is to the East of the seventy-five (75) acres studied by Brown 1988. The site is Creosote scrub with blackbrush, much Mormon tea and creosote bush dominant at lower elevations. Creosote bush predominates at the lower elevations, however above approximately 4100 feet no more creosote bush is seen. Joshua trees were seen in this component up to the summit of this hill (4346') and one (1) beavertail cactus was observed in a rocky outcrop. No sensitive, threatened or endangered floral species were found.

The Baltic Pit Extension (20 acres) and the Lamont Pit Extension (20 acres) were included in the 200 acre study conducted by McMains 1987. Parts of these components were also surveyed by Dodge 1993. Creosote scrub identified with numerous Mormon tea, burrobrush and blackbrush. No Joshua trees or cactus found in these small components though identified as in the area by McMains. No sensitive, threatened or endangered floral species found.

Satellite Pit (51 acres) is adjacent to the thirty (30) acre site studied by Gould 1989 and partly studied by McMains 1987 and Dodge 1993. All three agree that this is creosote scrub community with no sensitive, threatened or endangered species present. Some Joshua trees are present as well as cholla.

The Lamont Valley Waste Rock Stockpile (170 acres), the Lamont Valley Leach Pad (270 acres), the Lamont Valley Plant Site (20 acres) and the Lamont Valley Topsoil Stockpile (20 acres) is the primary focus of this current report. These components have mostly a southeasterly aspect, and while numerous trails and roads traverse the areas, the vegetation seems more dense. The vegetation type is classed as creosote scrub, with an understory of blackbrush, burrobrush, and bladder sage and 20 or more other desert shrubs and perennials. Numerous Joshua trees, articulated and nonarticulated were observed. Cholla was frequently seen but no beavertail cactus was found. No sensitive, threatened or endangered species were found.

The West Valley Waste Rock Stockpile (260 acres) and the West Valley

Topsoil Stockpile (20 acres) components are found on West facing slopes with mostly steep rugged canyons and ridges. A small portion of these components were studied by LaPre 1992 (45 acres). The study area is creosote bush scrub community with burrobrush, paperbag bush and raton. This steep west facing slope has poorly developed soil, is subject to rapid sheet erosion and the stature of the creosote bush as well as the other shrubs is somewhat less than seen in other sites. Joshua trees were present on the hillsides and one cottontop cactus with many stems was observed on the site. No sensitive, threatened or endangered species were seen.

The Descarga Area Leach Pad (60 acres) is to the East and Northeast of the existing Yellow Aster Dump and represents severely disturbed vegetation due to past mining activity and the close proximity of human habitation in the Randsburg area. The dominant vegetation is creosote bush, the understory shrubs are infrequent and the creosote bush has been severely impacted. No sensitive, threatened or endangered floral species were observed.

Descarga Area Plant Site (10 acres) is partially included in the 1992 LaPre study and is a severely disturbed site due to vehicular traffic into and out of extensive mining activity in the area. Creosote bush is the dominant vegetation with other typical associates already identified including a few (4 or 5) Joshua trees. No sensitive, threatened or endangered floral species were seen.

The Battle Waste Rock Stockpile (30 acres) was partially studied by Dodge 1993. The dominant vegetation is creosote bush scrub with blackbrush, Norman tea and burrobrush. A few Joshua trees are located in this component. No sensitive, threatened or endangered species were found.

The Haul and Exploration Roads (20 acres) are throughout the several components of the Rand Project and represent a composite of the previous cited studies. In all components cited above there have been no sensitive, threatened or endangered floral species discovered.

The natural plant community present in the several components of this project is creosote bush scrub. This vegetation zone is dominated by creosote bush in most of its expression, however many other shrub species are found in association and at higher elevations may dominate the floral scene. Other prominent associates include Norman tea, burrobrush, blackbrush, indigo bush, paperbag bush, buckwheat and up to 30 additional perennial shrubs. Joshua tree, while not present in the large numbers seen elsewhere in the Mohave desert are present in nearly every component studied. Three cactus species are sparsely present and include cottontop, beavertail cactus and cholla.

Numerous annual plants have been observed and collected. These tend to be most abundant under the shade of larger shrub species, especially creosote bush.

Appendix 2 contains a floral compendium derived from the several studies undertaken in the past. Collections made during this study will be preserved in herbarium sheets deposited with the Randsburg Area Bureau of Land Management Office, at their request.

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APPENDIX 1

Field Note Log

Date	Start	Location	Activity	Time
Rand Project				
3/2	Willis Willis Stillier Dodge	Rand	Overview/map Drive survey	3
3/21	Willis Dodge	Lamont V	Drive/walk Collections Photo	6
4/17	Willis Dodge	Lamont V	Drive/walk Collect Photo	3
4/30	Willis Dodge	Lamont V	Drive/walk Collect/Photo	4
4/30	Willis Willis Dodge	West V	Drive/walk Collect/	2
5/2	Cummings Dodge	Lamont	Drive/Walk Collect	5
6/3	Ellie Dodge	Lamont	Drive/Walk Collect	3
6/7	Harris Dodge	BLH	Confer Plant Collect	2
6/8	Ellie Dodge	West V	Drive/walk Collect/photo	4
6/8	Ellie Dodge	West V	Soil Analysis Vegeta ck/photo	2
6/25	Dodge	West V Descarga Yellow Aster Fit Exten	Drive/walk/photo Vegetation ck	7

Appendix 2 FLORAL COMPENDIUM

Ehretaceae

Ehretaceae

Ehretia nevadensis

Ehretia viridis

Mormon tea

Ehretia family

Nevada ehretia

mountain joint fir

Angiospermae

Dicotyledoneae

Flowering plants

Dicotyledons

Apiaceae

Lomatium mohavense

Carrot family

Mohave Lomatium

Asteraceae

Acamptopappus sphaerocephalus

Ambrosia dumosa

Artemisia ludoviciana

Chaenactis fremontii

Chrusothamnus nauseosus

Coreopsis californica

Encelia viridinensis

Eriophyllum wallacei

Filago depressa

Gutierrezia lucida

Haplopappus cooperi

Haplopappus linearifolius

Hymenoclea salsola

Macraeranthera tortifolia

Malacothrix glabrata

Malacothrix coulteri

Peucephyllum sonotii

Stephanomeria pauciflora

Tetradumia spinosa

Tetradumia stenolepis

Sunflower family

goldenhead

burrobush

sagebrush

Fremont pincushion

rabbit bush

coreopsis

brittlebush

Wallace's daisy

filago

matchweed

goldenbush

linear leaved goldenbush

cheesebush

Mohave aster

desert dandelion

Coulter's dandelion

desert fir

desert straw

cotton thorn

narrow-scaled reit-thorn

Boraginaceae

Amisimia tesellata

Coldenia pilcata

Eriogonum pterocarua

Eriogonum setosa

Plagiobothrus arizonicus

Borage family

fiddleneck

coldenia

forget-me-not

comb-pur

popcorn flower

Brassicaceae

Lepidium fremontii

Streptanthella longirostris

Thlaspiocarpus curvipes

Mustard family

desert alussum

long-beaked twist flower

curve-pod mustard

Lactaceae

Echinocactus polycephalus

Opuntia basilaris

Opuntia echinocarpa

Cactus family

cottontop

beavertail cactus

golden cholla

Umbelliferae

Goosefoot family

<i>Horridlex canescens</i>	snagscale
<i>Eurotia lanata</i>	winterfat
<i>Salsola kali</i>	Russian thistle
Convolvulaceae	Morning Glory Family
<i>Luscuta denticulata</i>	toothed dodder
Euphorbiaceae	Spurge Family
<i>Euphorbia albomarginata</i>	sand mat
Rabaceae	Pea Family
<i>Dalea fremontii</i>	Indigo bush
<i>Lotus</i> sp.	lotus
<i>Lupinus subvexus</i>	lupin
Geraniaceae	Geranium Family
<i>Erodium cicutarium</i>	storksbill
Hydrophyllaceae	Waterleaf Family
<i>Emmenanthe pendulifera</i>	whispering bells
<i>Phacelia fremontii</i>	phacelia
<i>Phacelia distans</i>	phacelia
<i>Phacelia taenictetifolia</i>	phacelia
Krameriaceae	Krameria Family
<i>Krameria parviflora</i>	Krameria
Lamiaceae	Mint Family
<i>Salazaria mexicana</i>	nadderbad bush
<i>Salvia carduacea</i>	thistle sage
<i>Salvia columbariae</i>	chia
Loasaceae	Stickleaf Family
<i>Nentzella nitens</i>	blazing star
<i>Petalonux thurberi</i>	sand-paper plant
Moctaginaceae	Four-o'clock Family
<i>Mirabilis bigelovii</i>	four-o'clock
Onagraceae	Evening Primrose Family
<i>Lamissonia brevipes</i>	evening primrose
<i>Lamissonia boothii</i>	bottle washer
Polemoniaceae	Phlox Family
<i>Gilia cana</i>	cana
<i>Gilia latiflora</i>	broad leaf gilia
Polygonaceae	Buckwheat Family
<i>Chorizanthe brevicornu</i>	spiny-herb
<i>Eriogonum balleui</i>	yellow buckwheat
<i>Eriogonum deflexum</i>	skeleton weed
<i>Eriogonum fasciculatum</i>	California buckwheat
<i>Eriogonum gracillimum</i>	slender stemmed buckwheat
<i>Eriogonum inflatum</i>	desert trumpet
<i>Eriogonum latifolium</i>	long trumpet
<i>Eriogonum nidularum</i>	birds nest buckwheat
<i>Eriogonum pusillum</i>	annual buckwheat

Eriogonum viridescens
Uxutheca perfoliata

duckweed
punctured bract

Portulacaceae
Caluptridium monandrum

Purslane Family
caluptridium

Ranunculaceae
Delphinium parishii

Crowfoot Family
larkspur

Rosaceae
Coleogyne ramosissima

Rose Family
blackbrush

Solanaceae
Lycium andersonii
Lycium cooperi

Evening Nightshade Family
Anderson thornbush
peach thorn

Zygophyllaceae
Larrea tridentata

Caltrop Family
creosote bush

Monocotyledonae

Monocotyledons

Agavaceae
Yucca brevifolia

Agave Family
Joshua tree

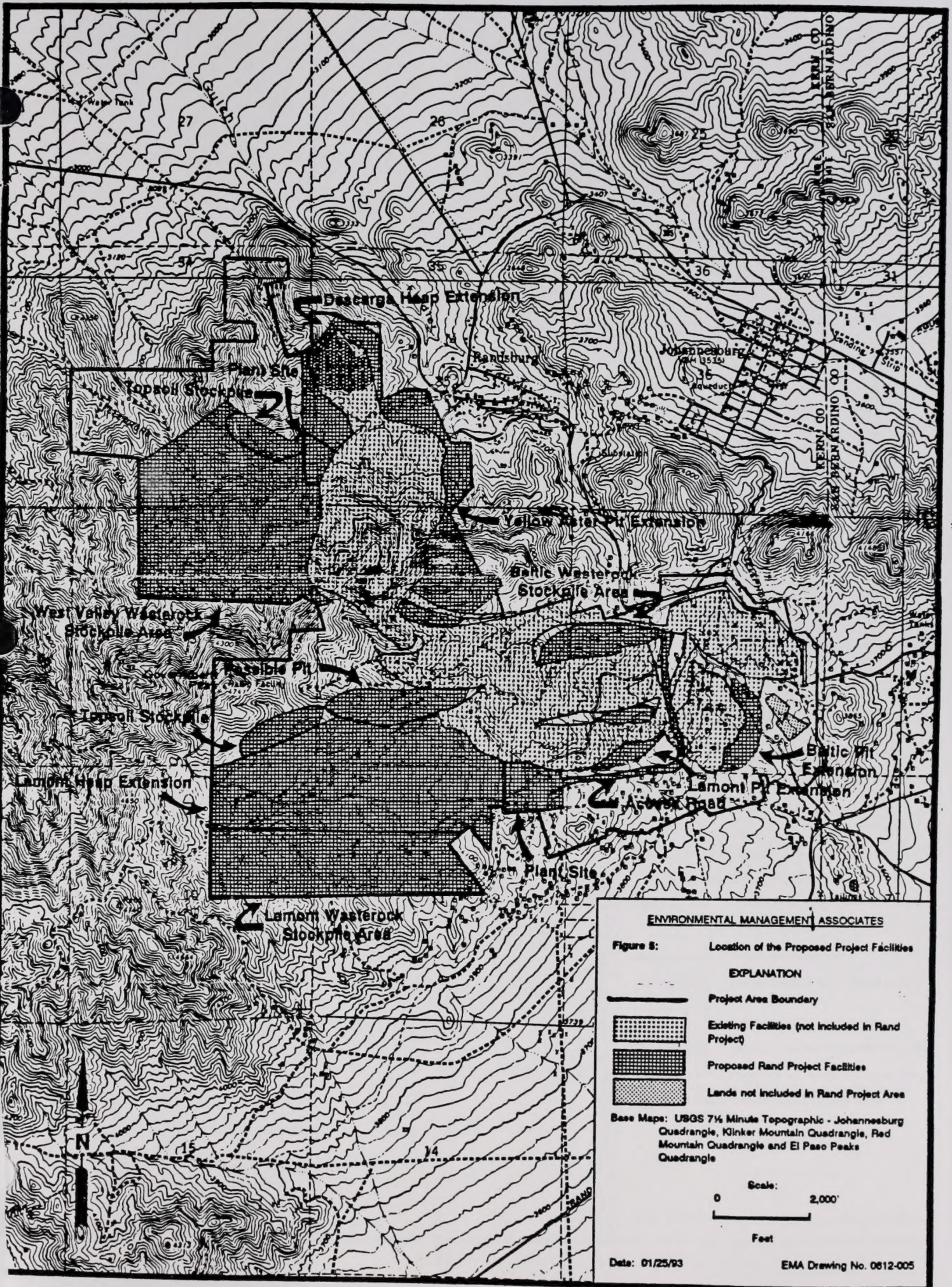
Amaranthaceae
Dichelostemma pulchella

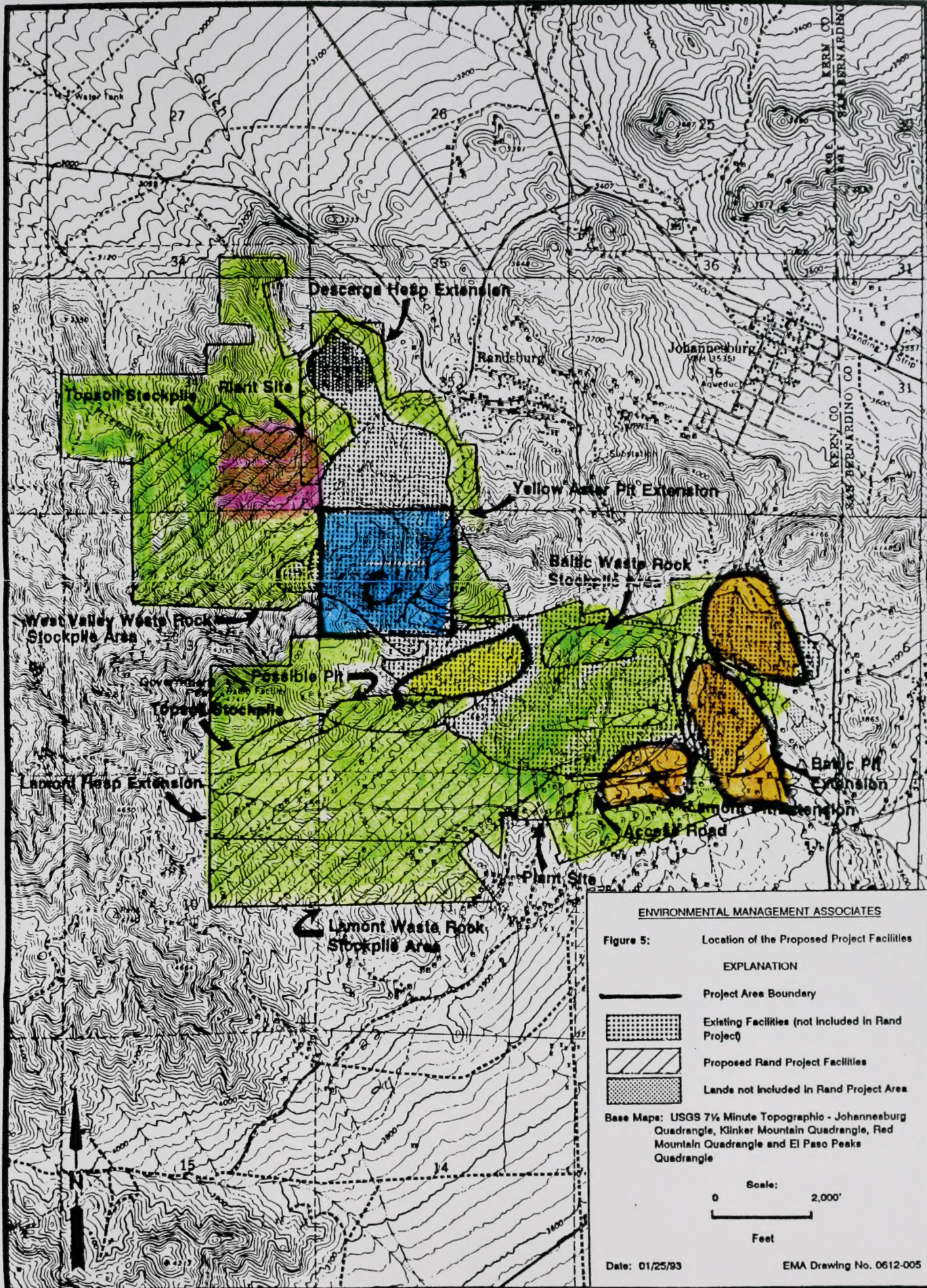
Amaranth Family
blue dicks

Poaceae
Bromus rubens
Bromus tectorum
Brizopsis humenoides
Poa secunda
Schismus aranicus
Schismus barbatus
Stipa speciosa

Grass Family
red brome
cheatgrass
Indian ricegrass
poa
Arabian schismus
abu mashi
desert needlegrass

This is not intended to be an exhaustive listing of the floral components present in these several project components. It is a synthesis of the several previous studies as well as the collections and observations of the present study).





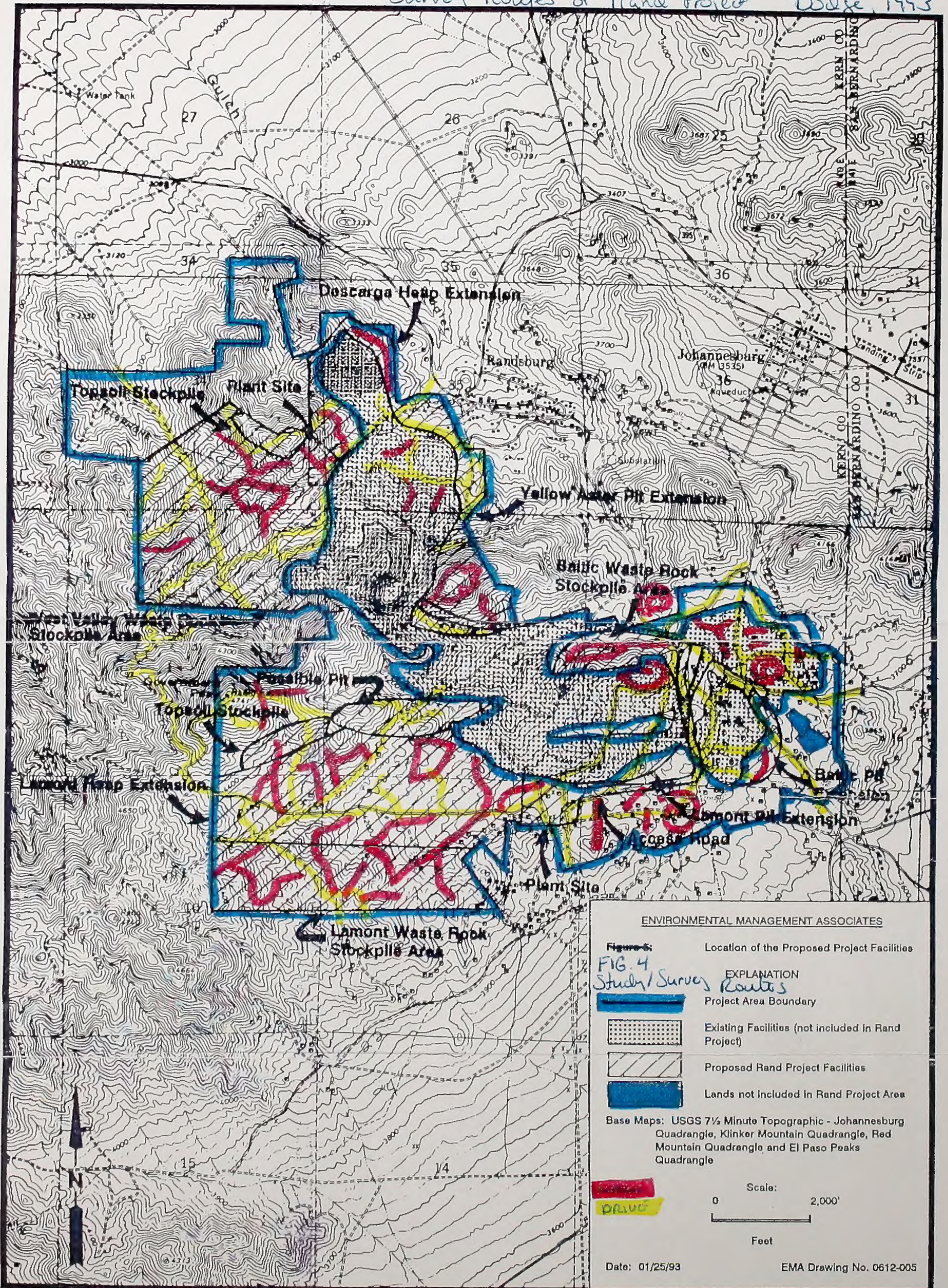
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McMains, 1997
Brown, 1988
Gould, 1989

VEGETATION SURVEYS

LaPre 92

DODGE 92/93



APPENDIX H

Biological Assessment, The Rand Project, Kern County, California

**BIOLOGICAL ASSESSMENT
THE RAND PROJECT
KERN COUNTY, CALIFORNIA**

Prepared for:

**Rand Mining Company
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Submitted to:

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2700 M Street
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and

**Bureau of Land Management
Ridgecrest Resource Area Office
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Prepared by:

**Ted Rado
3144 Celeste Drive
Riverside, California 92507**

April 1993

TABLE OF CONTENTS

	page
1.0 INTRODUCTION	1
1.1 Introduction	1
1.1.1 Objectives	1
1.1.2 Species Addressed	1
1.2 Project Background	1
1.2.1 Location	1
1.2.2 Planned Actions	3
1.2 Endangered Species Act Compliance .	3
2.0 PROPOSED ACTION	3
2.1 Components of Project	3
2.1.1 Mining Operations	3
2.1.2 Waste Rock Stockpile Areas .	5
2.1.3 Heap Leach Facilities	5
2.1.4 Related Facilities	7
2.1.5 Exploratory Activities	7
2.1.6 Personnel	7
2.2 Surface Disturbance	7
3.0 AFFECTED ENVIRONMENT	8
3.1 General Description	8
3.2 Land Status	10
3.3 Vegetation and Wildlife	11
3.3.1 Background	11
3.3.3.1 Information Sources .	11
3.3.3.2 Field Surveys	11
3.3.2 Vegetation	14
3.3.3 Wildlife	16
3.4 Results of Field Surveys	20
3.4.1 Sensitive Plants	20
3.4.2 Wildlife	20
4.0 ANTICIPATED PROJECT EFFECTS AND PROTECTION MEASURES	22
4.1 Introduction	22
4.2 Impacts	23
4.2.1 Habitat Disturbance	23
4.4.2 Effects to Wildlife	23
4.2.3 Incidental Take of Listed Species	24
4.2.4 Impacts to Other Sensitive Species	26
4.2.4 Cumulative Effects	26

TABLE OF CONTENTS (Continued)

	page
4.3 Protection Measures	27
4.3.1 Protection	27
4.3.2 Compensation	35
5.0 CONCLUSION	36
6.0 REFERENCES	37

APPENDICES

Appendix A: Species Lists

Appendix B: Map Showing Locations of
Sensitive Species and Sign

Desert Tortoise Table

Appendix C: Resumes

Appendix D: Site Photographs

TABLE OF CONTENTS

	page
Table 1. Estimated Amounts of Acreage That Will be Subject to Disturbance From the Rand Project (Source: Rand Mining Company)	8
Table 2. Field Survey Techniques and Survey Dates	13
Table 3. Sensitive Plant Species Recorded From the General Vicinity of the Rand Project Area	15
Table 4. Sensitive Wildlife Species Recorded From the General Vicinity of the Rand Project Area	16
Table 5. Mohave Ground Squirrel Records in the Vicinity of the Rand Project Area	19
Table 6. Summary of Desert Tortoises and Sign Observed During the Survey of the Rand Project Area	21
Figure 1. General Location of Project Area	2
Figure 2. Rand Project, Showing Boundaries and Topographic Features of Project Area	4
Figure 3. Rand Project, Showing Project Buildout and Existing Development in Area	6
Figure 4. Rand Project, showing Boundaries of Public Lands and Patented Lands	10

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861. It is a very important document, as it sets out the President's policy for the new year.

2. The second part of the document is a report from the Secretary of the Treasury, dated January 1, 1861. It contains a detailed account of the financial state of the country at the beginning of the year.

3. The third part of the document is a report from the Secretary of the Interior, dated January 1, 1861. It contains a detailed account of the state of the interior of the country at the beginning of the year.

4. The fourth part of the document is a report from the Secretary of the Navy, dated January 1, 1861. It contains a detailed account of the state of the Navy at the beginning of the year.

5. The fifth part of the document is a report from the Secretary of the War, dated January 1, 1861. It contains a detailed account of the state of the War at the beginning of the year.

6. The sixth part of the document is a report from the Secretary of the State, dated January 1, 1861. It contains a detailed account of the state of the State at the beginning of the year.

7. The seventh part of the document is a report from the Secretary of the War, dated January 1, 1861. It contains a detailed account of the state of the War at the beginning of the year.

1.0 INTRODUCTION

1.1 Introduction

1.1.1 Objectives

This Biological Assessment has been prepared to address the potential project effects to threatened and endangered species resulting from the proposed expansion of Rand Mining Company's (RMC) existing open pit and heap leach mining operations in the northern Rand Mountains near the community of Randsburg (Figure 1). Specifically, operations, hereinafter referred to as The Rand Project, will entail the mining of an additional 60 million tons of ore and 72 million tons of waste from three existing open pits and possible associated satellite deposits. Ores would be processed at existing and proposed recovery facilities. As a part of the project RMC also will reclaim existing Lamont facilities not previously covered in site reclamation plans.

The Biological Assessment has been prepared in conformance with Section 7(a)(2) of the Federal Endangered Species Act of 1973 (16 U.S. C. Section 1536), as amended. Information provided in the Biological Assessment will be used by the Bureau of Land Management (BLM), Ridgecrest Resource Area Office and the County of Kern Department of Planning and General Services (County) to prepare environmental review documents pursuant to the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The Biological Assessment will also provide required biological information needed by the U.S. Fish and Wildlife Service (USFWS) during future anticipated formal consultation pursuant to Section 7 of the Endangered Species Act.

1.1.2 Species Addressed

A single federally listed threatened species, the desert tortoise (Gopherus agassizii) has a geographic range that encompasses the proposed project area. Additionally, a State listed threatened species, the Mohave ground squirrel (Spermophilus mohavensis), is known to occur within the area. These species are discussed in Sections 3.3.3 and 3.3.4.

1.2 Project Background

1.2.1 Location

The project area is located approximately 40 miles northeast of Mojave. The site includes both the eastern and western sides of the northern portion of the Rand Mountains, extending south from the desert community of Randsburg. Project boundaries encompass a total of 2,520 acres, of which a maximum of 1,020 acres will be subject to proposed project-related development. Project

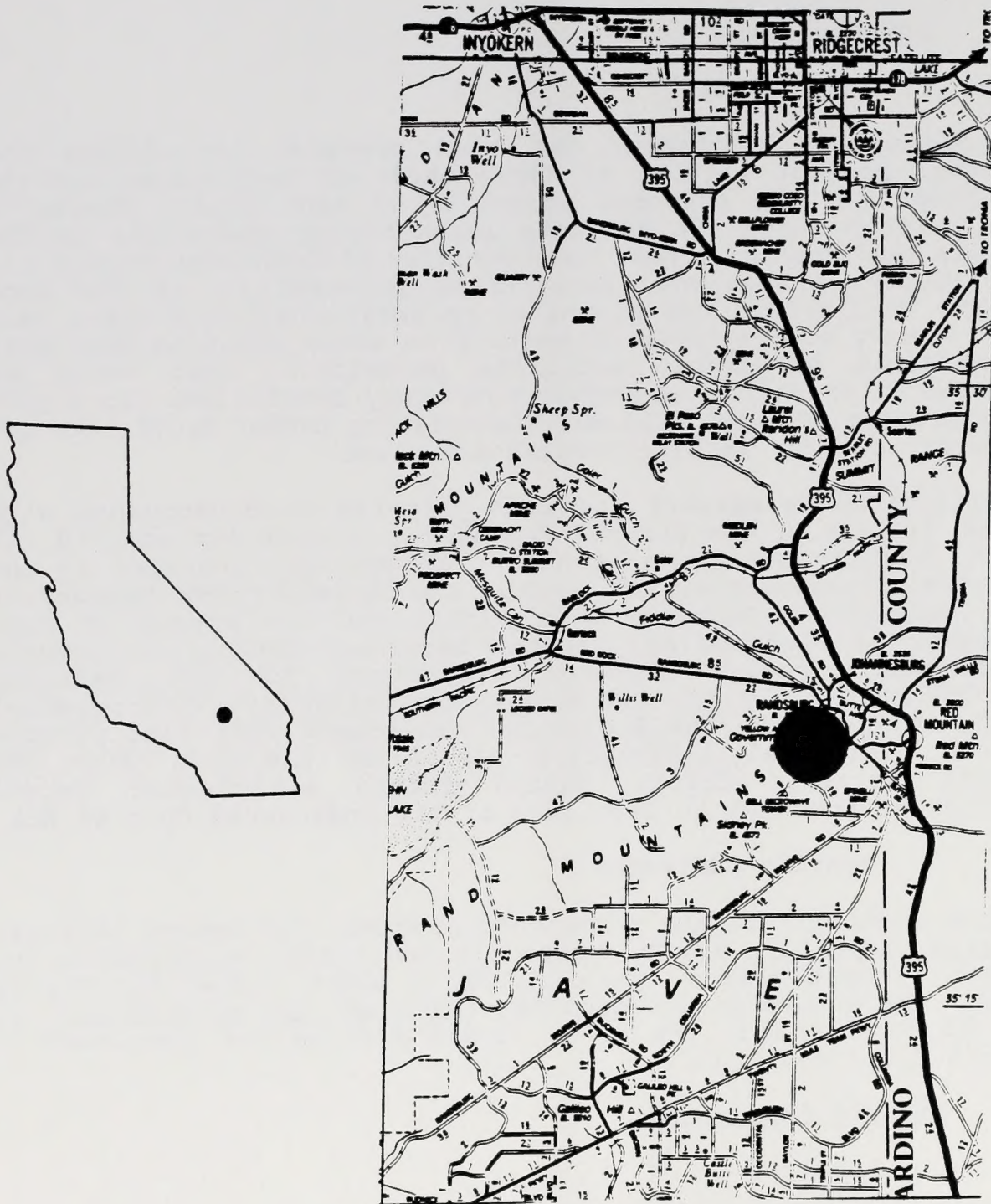


Figure 1. Project Area Location

boundaries are provided in Figure 2. Project actions will include portions of Sections 34 and 35 of Township 29 South, Range 40 East, as well as portions of Sections 1, 2, 3, 10, 11 and 12 of Township 30 South, Range 40 East, Mount Diablo Baseline Meridian. The project area includes both private lands and Public Lands administered by the U.S. Bureau of Land Management (BLM).

1.2.2 Planned Actions

Proposed activities would entail the expansion of three existing open pit operations (Yellow Aster, Baltic, and Lamont); development of satellite deposits; development of two waste rock stockpiles and two heap leach pads; development of two mineral recovery plants and other ancillary facilities; and creation of access roads to these sites. Proposed project actions would extend the life of the site mining operations by an additional nine years. A more complete description of project components is provided in Section 2.1.

1.3 Endangered Species Act Compliance

The Endangered Species Act of 1973, as amended, prohibits the Take (e.g., killing, harming, or harassment) of a listed species without special exemptions. Section 7(a) of this Act requires that Federal agencies responsible for authorizing projects that may adversely affect a listed species or adversely modify critical habitat designated for such a species, formally consult with the USFWS. The Biological Opinion subsequently issued to the requesting Federal agency by the USFWS determines whether that proposed action is likely to jeopardize the continued existence of the species. A section of the Opinion specifies Terms and Conditions under which the listed species may be taken. This section also determines appropriate levels of take, as defined by individual animals killed, injured, or moved, and amounts of habitats subject to temporary and permanent disturbance.

The BLM, as a Federal authorizing agency in this instance, is required to initiate formal consultation. The Biological Assessment prepared for this project shall be utilized in association with other project documents by the USFWS to prepare a Biological Opinion.

2.0 PROPOSED ACTION

2.1 COMPONENTS OF PROJECT

2.1.1 Mining Operations

A map showing locations of all proposed project actions within The Rand Project boundary is provided in Figure 3. Extraction of ore and removal of waste under The Rand Project would be accomplished in an identical manner to prior operations. Existing equipment

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861. It is a very important document, as it sets out the President's policy for the new year. The letter is written in a very formal and dignified style, and it is one of the most important documents in the history of the United States.

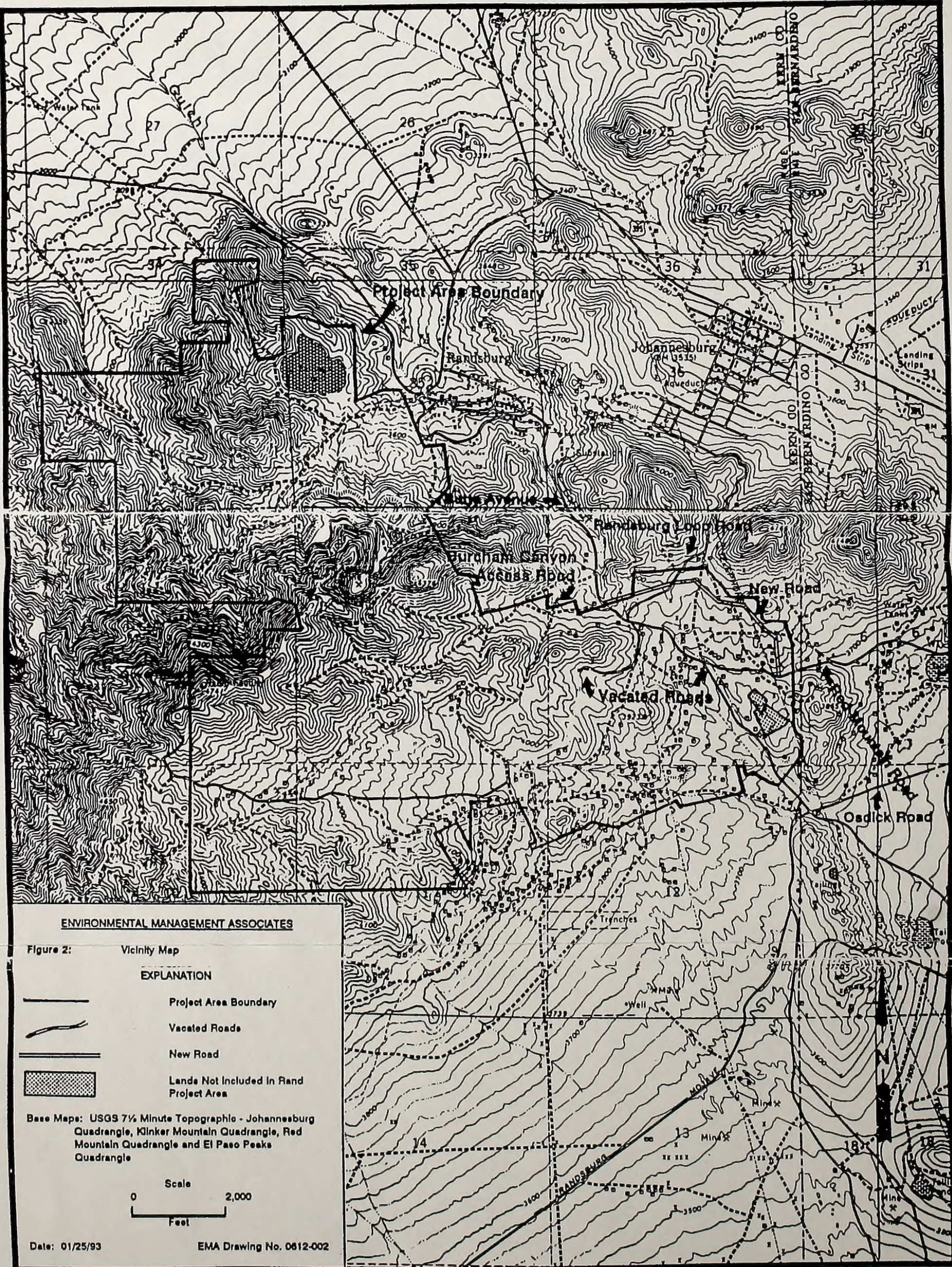
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Figure 2. Rand Project, showing boundaries and topographic features of project area (Source: Rand Mining Company)



Source: Environmental Management Associates 1993;
Printed With Permission of Rand Mining Company

currently on the site would be used to conduct these new operations. For purposes of The Rand Project, the following equipment is anticipated: (1) 5-7 haul trucks; (2) 2-3 front-end loaders; (3) 1 3-cubic yard loader; (4) 2 bulldozers; (5) 10 pickup trucks; (6) 2 flat bed trucks; (7) 1-2 graders; (8) 2 blasthole drill rigs; (9) 1-2 water trucks.

A total of 45,000-50,000 tons of material per day would be mined. Rocks would be removed by a process initially involving drilling and setting explosive charges and breaking up rock by setting off charges between 3-5 times per week. Rock rubble would be loaded into 85-100 ton capacity trucks. Ore would be hauled to heap leach pads for processing. Waste rock would be deposited in designated stockpile areas via haul roads.

2.1.2 Waste Rock Stockpile Areas

A total of two stockpile areas for waste rock are proposed. These will hold a maximum capacity of 72 million tons of rock upon project completion. One of the sites would be south of the existing Lamont Pit. The other site would be northwest of the Yellow Aster Pit. Additionally, the pre-existing Baltic waste rock stockpile area may be expanded.

2.1.3 Heap Leach Facilities

Two new ore processing (e.g., heap leach) facilities are proposed. Their development would entail the construction of solution ponds and the construction of a 270-acre heap leach pad in the Lamont Valley and a 60-acre heap leach pad in the Descarga Area (Figure 3). The Lamont Valley site would contain a maximum of 60 million tons of ore, and the remaining site would contain a maximum of 13 million tons of ore. Ore would be stacked on 25-foot-high terraces on each processing pad.

Primary ore processing would take place on the heap leach pad in the Lamont Valley. The smaller heap leach pad would not be constructed and used until such time as logistical and/or economic factors dictate.

Pad construction would involve the following actions: (1) initial grading of the site(s); (2) constructing collection channel and processing ponds; (3) constructing a combination access road/containment dike around the site(s); (4) constructing interceptor ditches around the site(s) to divert surface runoff around each; (5) lining the site(s) and placing leak detection systems. Ores for processing would be stacked using a front-end loader and bulldozer. Application of cyanide solutions would be accomplished using a drip irrigation system. Solutions would percolate through the leachate collection systems and flow to lined collection ditches. Ditches would run solutions to solution ponds where they would be pumped to plants for processing. Processing

The first thing I noticed when I stepped out of the car was the smell of fresh air. It was a relief after being stuck in traffic for so long. I looked around and saw a few people walking towards the entrance. I followed them and saw a sign that said "Welcome to the Museum". I felt a bit nervous, but I decided to go in.

As I walked through the museum, I saw many interesting exhibits. There were paintings, sculptures, and even some interactive displays. I was particularly interested in the section about ancient civilizations. I spent a lot of time looking at the artifacts and reading the information provided. I felt like I was stepping back in time.

My Favorite Exhibit

One of the things I loved most about the museum was the interactive displays. They were so engaging and informative. I especially enjoyed the one about the history of the city. It showed how the city had grown over the years and how it had changed. I was able to see the old buildings and the new ones side by side. It was really interesting.

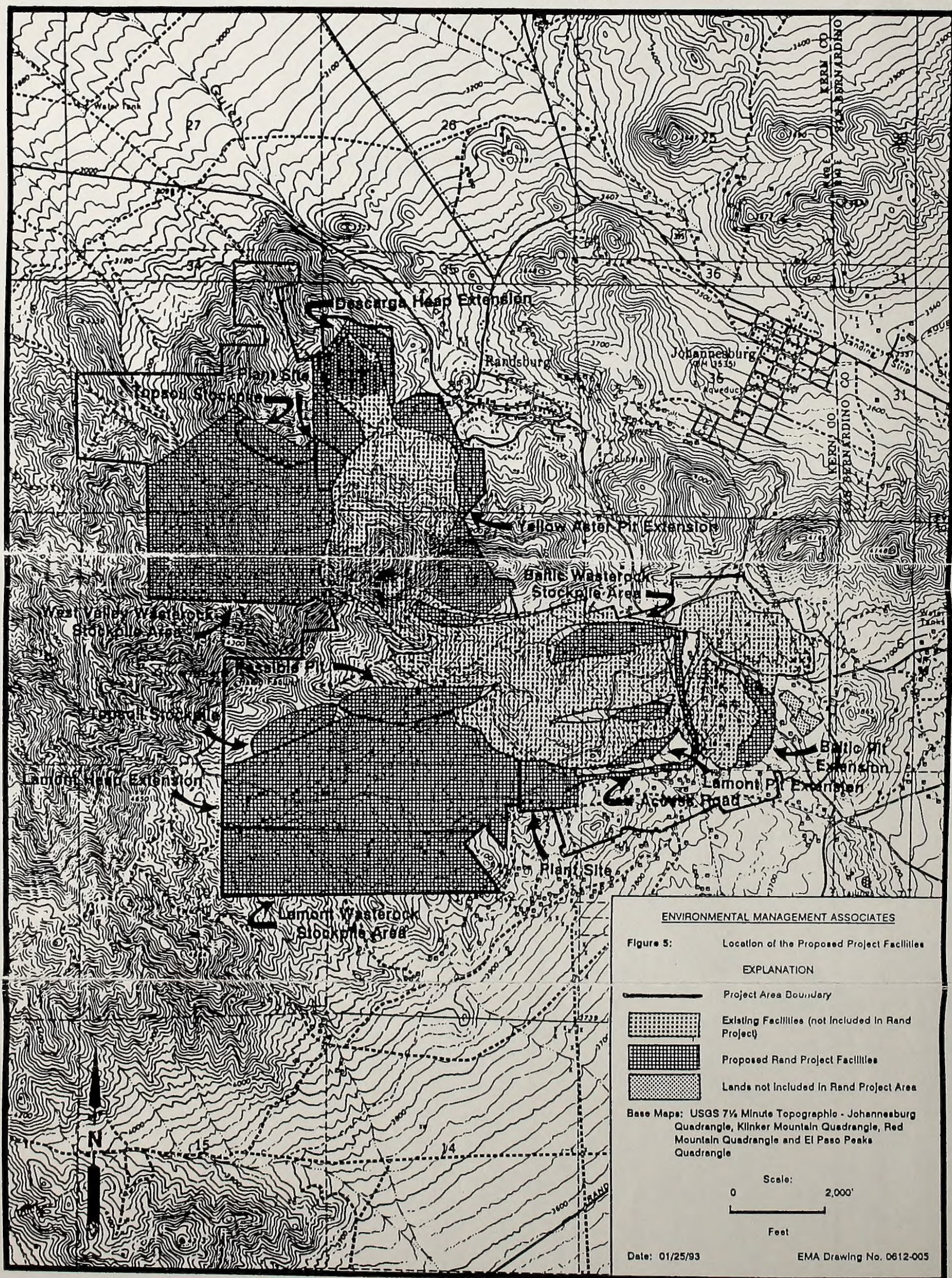
What I Learned

By the end of the day, I had learned a lot about the city and its history. I had seen some amazing art and I had enjoyed the interactive displays. I was really happy that I had spent the day at the museum. I had learned a lot and I had enjoyed every minute of it. I was looking forward to going back soon.

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Figure 3. Rand Project, showing projected buildout and existing development in area (Source: Rand Mining Company)



plants would be located within 100 by 100 foot sites, each constructed with synthetic liner and containment berms. Solution ponds would be covered with bird exclusion netting. Solution ditches would not be covered.

2.1.4 Related Facilities

Project facilities related to above operations would include offices, maintenance shop, water facilities, explosives magazines, diesel storage, laboratory, and furnace. Small substations would be constructed and connected to above and/or below ground electrical lines to supply power and lighting.

All water for processing would be obtained from RMC's existing water supply system. The existing water pipeline extending from Fremont Valley to the Yellow Aster facility would be upgraded and extended to the new processing facilities. All waters used during processing would be recycled. Potable water would be supplied by extending an existing line from the Yellow Aster Mine Project. This water is supplied by the Rand Communities Water District. All chemicals, except for pebble lime, would be stored in closed weather-proof containers within an secured storage area. Pebble lime would be stored on ore processing heaps. Explosives would be stored in existing permitted magazines. All chemicals would be stored in conformance with State and Federal regulations.

2.1.5 Exploratory Activities

Exploration activities would continue for the duration of the project. These actions would include: surveying, sampling, mapping, drilling, and bulk sampling. Currently, exploratory drilling is planned in the areas around the existing pits (e.g., Yellow Aster, Lamont, and Baltic) and in the western portion of the project area.

2.1.6 Personnel and Operations Hours

Currently, about 140 employees operate existing mining facilities. Approximately 30 are administrative, supervisory, or technical staff. The remainder operate the mining and processing facilities on rotating shifts 24 hours per day, year-around. An estimated 8 new employees would be hired as a result of The Rand Project.

2.2 PROJECT-RELATED SURFACE DISTURBANCE

Proposed activities under The Rand Project will result in the long-term disturbance to a maximum of 1,020 acres. Estimates of maximum acreages that will be subject to disturbance from various components of the project are provided in Table 1.

**Table 1. Estimated Amounts of Acreage That
May Be Subject to Disturbance from Rand
Project Actions (Source: Rand Mining Company)**

Project Action	Maximum Acreage Affected
Yellow Aster Pit Extension	70
Baltic Pit Extension	20
Lamont Pit Extension	20
Satellite Pit	30
Lamont Valley Waste Rock Stockpile	170
West Valley Waste Rock Stockpile	260
West Valley topsoil Stockpile	20
Lamont Valley Leach Pad	270
Lamont Valley Plant Site	20
Descarga Area Leach Pad	60
Descarga Area Plant Site	10
Baltic Waste Rock Stockpile	30
Lamont Valley Topsoil Stockpile	20
Haul and Exploration Roads	20
Total	1020

Project-related surface disturbance will not occur at a uniform rate. The project will be constructed and operated in phases. currently, five (5) phases are envisioned, depending upon the physical and economic factors upon which the project depends. As currently planned, each phase will be developed every two years following project inception (Steve Stiller, Rand Mining Company, pers. comm.).

The maximum amount of acreage which may be affected is 1,020 acres. It is expected that the actual acreage of habitats which will be affected will be considerably less. The actual amount modified as a result of project actions will depend upon the detailed engineering and siting work that is currently in progress. This work will minimize the amount of habitat to be affected by project activities (Steve Stiller, Rand Mining Company, pers. comm.).

3.0 AFFECTED ENVIRONMENT

3.1 GENERAL DESCRIPTION OF THE ENVIRONMENT

The mining project site includes the northern portion of the Rand Mountains, an isolated range bordered on the west by the Fremont Valley. Topography is varied. Landforms in the eastern and southern portion of the project area consist of gently rising hills and ridgelines climbing northwest towards Government Peak. Small

valleys ringed by low hills and ridges dominate the eastern and southern portions of the project area. The northern and northwestern portions of the project area are considerably more rugged, with steeply rising hills and narrow drainages sloping northerly from the Rand Mountain peaks. Elevational gradients reflect this disparity in landform, ranging from approximately 3200 feet to 4741 feet. Soils consist of coarse sands and fine gravels. Rock outcrops ranging from exfoliating shales to boulder-strewn hillslopes and ridgelines are also present.

Vegetation throughout the project area is present over a total of 1618 acres and consists of creosote bush scrub. Dominant perennial vegetation includes creosote bush (Larrea tridentata), burrobush (Ambrosia dumosa), cheesebush (Hymenoclea salsola), and Mojave aster (Machaeranthera tortifolia). Additional common shrubs include blackbrush (Coleogyne ramosissima) that predominates at higher elevations and on northerly-facing slopes, brittlebush (Encelia farinosa), and Anderson thornbush (Lycium Andersonii). Joshua trees (Yucca brevifolia) are widely scattered within the project area. Common annual plants include red-stemmed filaree (Erodium cicutarium), checker fiddleneck (Amsinkia tessellata), schismus (Schismus arabicus), popcorn flower (Cryptantha spp.) and Bigelow's coreopsis (Coreopsis bigelovii).

Wildlife species present within the project area are typical of those present in the central Mojave Desert. Species observed during field surveys include those widely distributed in the desert, such as the black-throated sparrow (Amphispiza bilineata), horned lark (Eremophila alpestris), antelope ground squirrel (Ammospermophilus leucurus), Panamint kangaroo rat (Dipodomys panamintinus), black-tailed jackrabbit (Lepus californicus) and side-blotched lizard (Uta stansburiana). There are no unique or wetland habitats present on the site that would serve to provide for higher species diversity than surrounding areas.

The Rand Project lies within the geographic range of the State and federally listed threatened desert tortoise (Gopherus agassizii). The BLM, in analyzing over 2,000 strip-transects conducted desert-wide, determined that tortoise densities in that portion of the Rand Mountains that encompass the Rand Project area are between 0-20 per square mile (Berry et al. 1984). Significantly higher densities, ranging from 20-50 per square mile to over 250 per square mile occur immediately to the south and west of the project site (BLM data). Exclusive of approximately 40 acres of Category 1 desert tortoise habitat within the western portion of Section 34 (that is not slated for development), The Rand Project lies within undesignated tortoise habitat. Portions of such areas, where tortoises and sign are subsequently located, are treated as Category 3 desert tortoise habitats (Bob Parker, BLM, pers. comm.).

The Rand Project site also lies within the geographic range of the State listed threatened Mohave ground squirrel (Spermophilus

mohavensis). There are no specific studies that provide information of the densities of this species within or near the project site. However, several observations have been made within 1-5 miles of the Rand Project, and the Mohave ground squirrel has been observed directly on the project site (Dr. Patricia Brown, pers. observation).

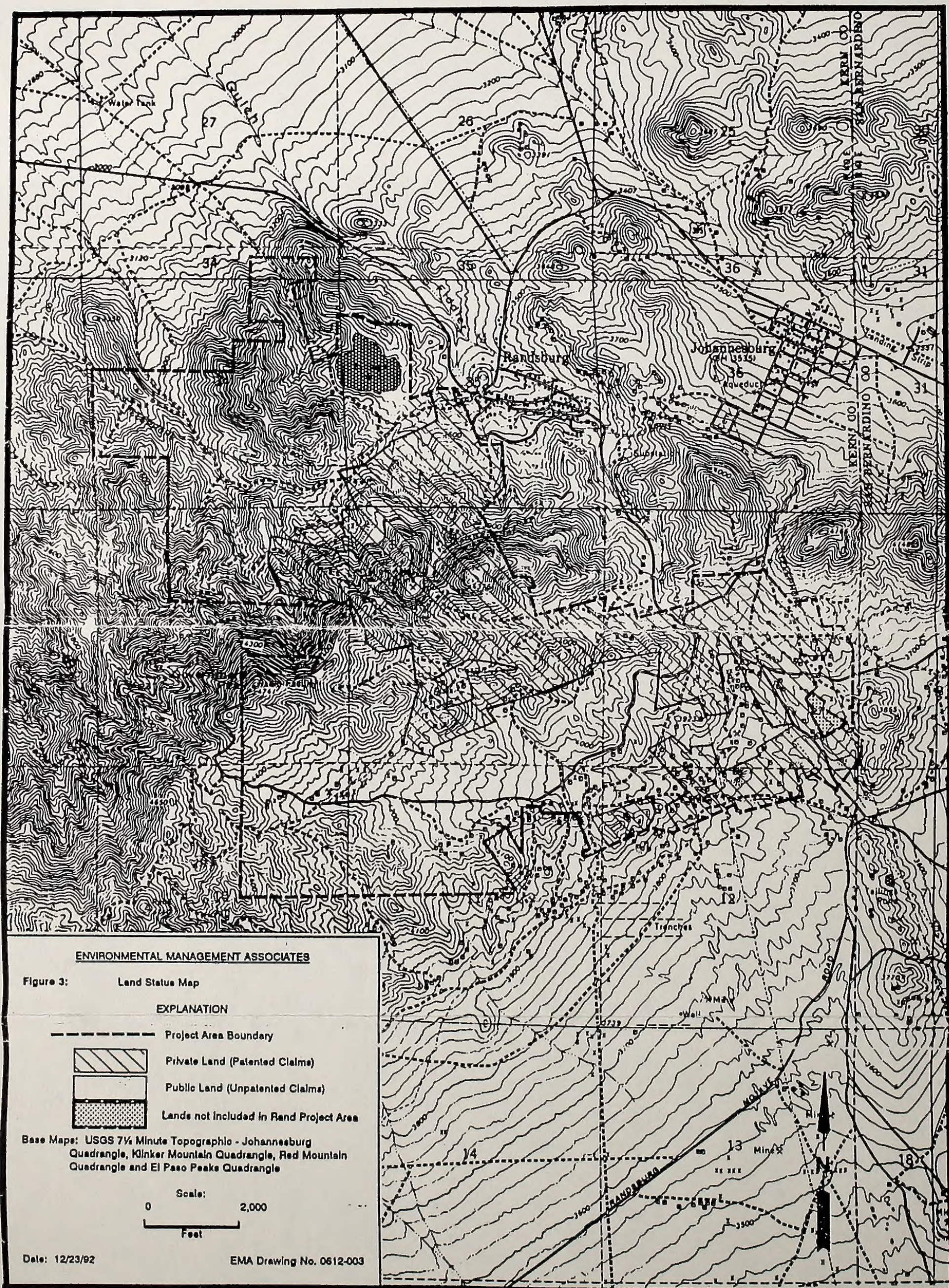
A significant portion of the project area has been subject to prior and ongoing land disturbance from a variety of Man-induced activities. Old mine shafts, exploratory shafts and tunnels, trenches, ore tailings piles, roads, and dumps area present throughout the area. These have been created by large-scale mining activity that originated in the area beginning in the 1880's. More recently, large-scale mining from the Yellow Aster and Baltic projects undertaken by the Rand Mining Company have created large mining pits and associated ore processing areas and tailings piles, with ancillary buildings, equipment storage, access roads, and parking areas. These project actions have been addressed in separate environmental review documents (EMA 1990, EMA 1992).

The entire area that encompasses the Rand Project has also been subject to livestock grazing by domestic sheep. evidence of old sheep use includes weathering skeletal remains of sheep, dried scat, and old trailing. No current livestock use on the site is taking place.

Motorized recreational use over portions of the area not subject to current mining commonly occurs on weekends. Use is principally related to individual and group motorcycle riding. Groups of up to eight motorcycles have been observed on the weekends on the project area. Although motorcyclists usually conform to vehicle use restrictions requiring use on designated roads and trails only, motorcycles and trucks have been observed on the project site travelling cross-country and hillclimbing. Such illegal vehicle use has resulted in the creation of numerous OHV tracks and trails, with attendant damage to area shrubs, soils compaction and erosion, and hillside scarring.

A double row of large transmission lines, maintained by Southern California Edison Company crosses portions of the project area in Sections 1 and 12 of Township 30 South, Range 40 East (Figure 2). A graded dirt access road parallels these transmission towers. A smaller transmission line, connecting to existing office/administrative and work areas for the Yellow Aster Mine project also extends across these sections and portions of adjacent Section 2. A small telephone line also extends across the northern slope of the Rand Mountains from the Fremont Valley, connecting to Randsburg. This above-ground pole line crosses portions of Sections 34 and 35 of Township 29 South, Range 40 East in the project area (Figure 2). The desert community of Randsburg, with a population of approximately 150 residents, is immediately north of the Rand Project boundary.

Figure 4. Rand Project area, showing boundaries of patented lands and private lands (Source: Rand Mining Company)



Source: Environmental Management Associates 1993;
Printed With Permission of Rand Mining Company

Access to the Rand Project area is via State Highway 395 and Butte Avenue, a secondary paved road that extends from Randsburg. The Randsburg-Mojave Road also provides access to the northern portion of the Rand Project Area. Numerous secondary unpaved roads provide access to all portions of the project area.

3.2 LAND STATUS

The Rand Project includes 875 acres of private lands, consisting of patented mining claims, and 1,645 acres of Public Lands administered by the U.S. Bureau of Land Management. The boundaries of these lands are provided in Figure 4. Under proposed actions, a maximum of 243 acres of private lands and a maximum of 777 acres of Public Lands would be modified as a consequence of project-related activities (Steve Baumann, Rand Mining Company, pers. comm.).

A portion of the project area, extending from the westerly and southwesterly portions of the Rand Project boundary, is within the designated Rand Mountains/Fremont Valley Management Area (BLM 1990b, Illustration 4). That portion of the Rand Project present within the Management Area lies entirely within BLM-designated Class M (e.g., moderate levels of use permitted) lands. Mining activities are permitted on Class M lands under the plan guidelines. Additionally, that portion of the Management Area encompassing a portion of the Rand Project will not be withdrawn from mineral reservation as a part of management plan actions (BLM 1990b, Illustration 7).

3.3 VEGETATION AND WILDLIFE

3.3.1 Background

3.3.1.1 Information Sources

Occurrence of plant and wildlife species in the project area was determined using several methods. A check of existing information in the California Natural Diversity Database (CNDDB) records was undertaken during the winter of 1992. This information was supplemented with examination of prior inventories proximate to and within portions of the Rand Project area (McMains 1987; Brown 1988, 1992; Gould 1988; Rado 1990, 1991, 1992; O'Farrell Biological Consulting 1990). Literature (Jaeger 1969, Munz 1974, Hall 1981) and database records (CNPS 1988) were supplemented with reviews of agency reports (Hoyt 1975, Berry et al. 1984, Aardahl and Roush 1985, BLM 1990). Sensitive species locality and life history information were compiled from the above sources and from species-specific sources (Burt 1936, Wessman 1977, Zembal and Gall 1980). These sources are more specifically referenced in the following pages.

Additionally, prior incidental observations of wildlife in the

project area by the principal biologist were used to compile species lists provided in the Appendix.

3.3.1.2 Field Surveys

Field surveys of the Rand Project area were initiated on February 1, 1993, and completed on March 19, 1993 (Table 2). Surveys consisted of several methods:

1. Line transects spaced at 30-foot-wide intervals walked over all currently vegetated portions of the project area in an effort to locate and map desert tortoises and sign (e.g., burrows, pellets, scat, tracks, and skeletal remains).
2. Completion of Cumulative Human Impact Evaluation Forms over all vegetated portion of the Rand Project area for the State-listed Mohave ground squirrel; and
3. Transects for area plants, conducted over all vegetated portions of the project area.

Table 2. Field Survey Techniques and Survey Dates

Type of Survey	Focus of Survey	Survey Dates
Line Transects (30-ft-spacing)	Desert Tortoise/ sensitive species/ species lists	2/2, 2/3, 2/4, 2/5, 2/6, 2/7, 2/11, 2/12, 2/13, 2/14, 2/15, 2/16, 2/21, 2/23, 3/9, 3/10, 3/11, 3/12/93
CHIEF Transects (meandering)	Mohave Ground Squirrel	2/24, 2/25, 3/1, 3/2, 3/3
Plant Transects	Plant Lists/ Annuals	3/19/93

Parallel line transects spaced at 30-foot-wide intervals were walked over the entire project site, exclusive of approximately 20 total acres on extremely steep slopes that were not surveyed for safety reasons. Field surveys were initiated on February 1, 1993, and concluded on March 12, 1993. Biologists conducting these inventories recorded observations of live desert tortoises and sign (e.g., carcasses, bone and shell fragments, burrows, pellets, scat, tracks, etc.) on standardized field survey forms developed by the U.S. Fish and Wildlife Service. Observations of other wildlife and lists of plants observed were also maintained and are provided in Appendix A. Due to rugged topography, transects generally parallel

slope contour lines, rather than follow an east-west direction. A total of four biologists participated in the desert tortoise survey. All meet qualification requirements of the BLM, California Department of Fish and Game, and U.S. Fish and Wildlife Service. Each has additionally conducted project surveys for this species within the Mojave Desert. Resumes of each are provided in the Biological Assessment Appendix.

The potential for the occurrence of the State-listed Mohave ground squirrel within the Rand Project was based on habitat evaluation and assessment of current and prior land uses within the geographic range of this species. The CDFG, as the State agency that oversees the protection of this species, has recently developed a set of protocols to evaluate the potential effects of project actions on Mohave ground squirrel habitat. These procedures entail the completion of Cumulative Human Impact Evaluation Forms (CHIEF forms) for submittal to the CDFG for review. Based on this information, the CDFG will determine if pursuance of a State "2081" permit will be required for the specific project action. An integral component of this permitting process is development of measures that reduce and/or offset anticipated project effects to the Mohave ground squirrel and its habitat. The entire project area was subdivided into 17 polygons. A qualified biologist (e.g., a biologist that has completed CDFG-approved CHIEF training) conducted a field examination of each polygon between February 24 and March 12, 1993. Two biologists participated in this survey. Prepared CHIEF forms and associated photographs and field maps are provided in a supplemental report to this Biological Assessment (Rado 1993).

Plant taxa identified during the above transects were supplemented with a specific site visit on March 19, 1993. The focus of this field visit was to identify spring annual species. All portions of the project area were visited, with emphasis placed on: (1) portions of the project area slated for development; (2) different facing slopes and soil types; and (3) sampling the elevational gradient. Several annuals were collected at that time and keyed using Hickman (1993).

3.3.2 Vegetation

3.3.2.1 General Description

The entire project site consists of creosote bush scrub habitat. Vegetation in the site is dominated by creosote bush, burrobush, cheesebush, California buckwheat (Eriogonum fasciculatum), Mojave aster (Machaeranthera tortifolia), brittlebush (Encelia farinosa), Nevada joint fir (Ephedra nevadensis) and blackbrush. Other conspicuous perennials include widely scattered Joshua trees (Yucca brevifolia), beavertail cactus (Opuntia basilaris), narrow-leaved thornbush (Lycium andersonii), desert trumpet (Eriogonum inflatum), and needlegrass (Stipa speciosa).

Distribution of these plants is heavily influenced by both slope exposure and elevation. In lower elevations and on south-facing slopes, creosote bush, cheesebush and burrobrush heavily predominate; blackbrush assumes increasing dominance on north-facing slopes and at elevations over 4300 feet.

Conspicuous annuals include downy chess (Bromus tectorum), arabian grass (Schismus arabicus), Fremont phacelia (Phacelia fremontii), red-stemmed filaree (Erodium cicutarium), popcorn flower (Cryptantha spp.), and Bigelow's coreopsis (Coreopsis bigelovii). A total of 94 plant species have been identified on the site (Appendix A).

3.3.2.2 Sensitive Plant Species

A single State listed rare species, the Kern tarplant (Hemizonia pallida), has been recorded from the general vicinity of the Rand Project. There are no State or federally listed threatened or endangered plants either known or expected to occur within the project area. Four plant taxa listed by the California Native Plant Society (CNPS 1988) have been recorded from the general area and are listed in Table 3.

Table 3. Sensitive Plant Species Recorded From the General Vicinity of the Rand Project Area

Species	Status
Mojave fishhook cactus (<u>Sclerocactus polyancistris</u>)	CNPS 4
Mojave spineflower (<u>Chorizanthe spinosa</u>)	CNPS 4
Kern tarplant (<u>Hemizonia pallida</u>)	C1/SR/CNPS1B
Charlotte's phacelia (<u>Phacelia nashiana</u>)	CNPS 1B

*SR=State listed as Rare; C1 = Federal Category 1 species (sufficient information to warrant listing); CNPS 4 = plants of limited distribution
CNPS 1B = considered to be rare, threatened and endangered in California and elsewhere

The first two taxa are plants of limited distribution that the California Native Plant Society maintains on a "watch" list. Charlotte's phacelia has a limited distribution within east-facing

slopes of the Sierra Nevada approximately 20-30 miles from the Rand Project. Kern tarplant has been recorded from the vicinity of Cantil in the Fremont Valley, about 10-15 miles southwest of the Rand Project. The microhabitats favored by this species are not present in the Rand Project area.

3.3.3 Wildlife

3.3.3.1 General Description

Wildlife species recorded from the area in previous inventories are typical of the central Mojave Desert. These species include a variety of resident and migrant birds, small mammals, and reptiles. No amphibians are present due to extreme aridity and the absence of springs, seepages or other microhabitats affording protection from desiccation. Bird species include the common raven (Corvus corax), red-tailed hawk (Buteo jamaicensis), chuckar (Alectoris graeca), black-throated sparrow, horned lark, and rock wren (Salpinctes obsoletus). Mammals include the desert woodrat (Neotoma lepida), western pipistrelle bat (Pipistrellus hesperus), desert cottontail (Sylvilagus auduboni) and coyote (Canis latrans). Reptile species include the desert tortoise (Gopherus agassizii), desert spiny lizard (Sceloporus magister), western whiptail (Cnemidophorus tigris), long-nosed snake (Rhinocheilus lecontei), gopher snake (Pituophis melanoleucus), and sidewinder (Crotalus cerastes). A complete listing of wildlife species observed during surveys and from prior observation is provided in Appendix B.

3.3.3.2 Sensitive Wildlife Species

A total of two listed species, the desert tortoise and Mohave ground squirrel, occur in the project area. No other federally or State listed threatened or endangered species are known or expected to occur here. A listing of other sensitive wildlife species that have been recorded from the general area is provided in Table 4. Life history text on the desert tortoise and Mohave ground squirrel follows.

Table 4. Sensitive Wildlife Species Recorded From the General Vicinity of the Rand Project Area

Species	Status
Reptiles	
desert tortoise (<u>Gopherus agassizii</u>)	FT/ST

Table 4. Continued

Species	Status
Birds	
golden eagle (<u>Aquila chrysaetos</u>)	CSC
ferruginous hawk (<u>Buteo regalis</u>)	CSC
northern harrier (<u>Circus cyaneus</u>)	CSC
prairie falcon (<u>Falco mexicanus</u>)	CSC
barn owl (<u>Tyto alba</u>)	CSC
burrowing owl (<u>Athene cunicularia</u>)	CSC
LeConte's thrasher (<u>Toxostoma lecontei</u>)	CSC
Mammals	
Townsend's big-eared bat (<u>Pleocotus townsendii</u>)	C2/CSC
Mohave ground squirrel (<u>Spermophilus mohavensis</u>)	C2/ST
American badger (<u>Taxidea taxus</u>)	CSC

*ST=State listed as threatened; FT=Federally listed as threatened; C2=Federal Category 2 species (more information on status needed); CSC=Designated by the California Department of Fish and Game as a Species of Concern

Desert Tortoise

The desert tortoise was State listed as a threatened species on June 22, 1989 [California Code of Regulations, Section 670.5(b)(4) of Title 14], and federally listed as endangered under the emergency provisions of the Federal Endangered Species Act on

August 4, 1989 (54 Federal Register 32326-32331). This latter listing was changed to threatened on April 2, 1990 (55 Federal Register 12178-12191). Reasons for listing included habitat loss and fragmentation and population declines as a result of disease, predation, and Man-induced factors.

The desert tortoise is widely distributed over portions of the Mojave, Sonoran, and Colorado deserts of the western United States and northwestern Mexico. Habitats occupied include plains and valleys in the Mojave Desert, bajadas and low mountain slopes in the Sonoran Desert, and thorn scrub forest in Mexico. Dominant vegetation includes creosote bush, burrobrush, Joshua trees, ocotillo, palo verde, and several species of saltbush (Woodbury and Hardy 1948; Schwartzmann and Ohmart 1977; Berry 1975, 1984).

The desert tortoise is a highly adapted, adept digger. Burrows are constructed to avoid harsh temperatures and to avoid predators. Burrows used by tortoises include a shallow "pallet" that is used regularly during seasonal activity periods, and a deeper, more extensive burrow that is used during periods of inactivity (Woodbury and Hardy 1948; Berry 1975). Burrows may be constructed almost anywhere, including under boulders, canopies of shrubs, wash embankments, or in the open (Woodbury and Hardy 1948, Berry 1972, Burge 1976, Coombs 1977).

The species is herbivorous. Tortoises eat a variety of annual flowers, perennial grasses, a few half shrubs, and flowers of perennial shrubs. Desert tortoises also rely heavily on intermittent rainfall to re-hydrate, and will emerge in numbers immediately following the onset of spring and summer rains to drink (Medica et al. 1982).

Desert tortoises are mature at approximately 15-20 years of age (Woodbury and Hardy 1948). One to two clutches of 2-14 eggs are laid during the spring or early summer in or near the females burrow (Miller 1955; Turner et al. 1987). Eggs hatch in about 105-135 days (Coombs 1977). Individual animals may live for over 100 years (Woodbury and Hardy 1948).

Based on an extensive database compiled from over 2000 strip-transects and 30 study plots in California, desert tortoises are distributed over approximately 40,200 square miles. The majority of these lands contain tortoise densities of 0-20 animals per square mile (Berry and Nicholson 1984).

Desert tortoise populations have declined in recent years as a consequence of several factors. Man-induced activities, including urbanization, highway construction, livestock grazing, motorized recreation, utility and pipeline corridors, mineral exploration and

development, and energy development, have contributed to habitat loss and degradation (Berry 1984). Populations have also suffered major declines as a result of disease outbreaks and excessive predation by ravens, a major predator of juvenile tortoises (BLM et al. 1990a).

The species is known to occur over the project area. Prior surveys of portions of the site have documented live tortoises and sign (McMains 1987, Brown 1988, Gould, 1988, O'Farrell Biological Consulting 1990, Rado 1992). The Bureau of Land Management, analyzing regional strip transects completed during the California Desert Plan Program, has estimated densities ranging between 0-20 per square mile within this portion of the Rand Mountains (Berry et al. 1984). Higher tortoise densities, ranging between 20-50 to over 250 per square mile occur on the tablelands to the south and in the Fremont Valley immediately to the west of the project area.

Mohave Ground Squirrel

The Mohave ground squirrel is a small seasonally active diurnal species restricted to western and northern portions of the Mojave Desert in California. Distribution extends roughly from Olancho in Inyo County, through Mojave Desert portions of eastern Kern and Los Angeles Counties, south and east to the general vicinity of Victorville and Daggett (San Bernardino County). Specific locality records are available from several sources (Hoyt 1972, Wessman 1977, Aardahl and Roush 1985, Michael Brandman Associates 1988).

Habitats are varied, and include creosote bush scrub, Joshua tree woodland, and alkaline sink dominated by saltbush where soils are comprised of fine to coarse-mixed sands and gravels, and rocky terrain in rare instances (Burt 1936, Zembal and Gall 1980, Aardahl and Roush 1985). The species is seasonally active in the spring and early summer months, and relies heavily upon fruits and seeds as a food source.

The Mohave ground squirrel is listed as a threatened species by the State of California. Reasons for listing center around habitat loss and fragmentation as a result of agricultural development, urban development, mineral development, livestock grazing, and recreational vehicle use (CDFG, no date). Compared to the desert tortoise, little recent work has been conducted on this species. There are several records proximate to the Rand Project. These are provided in Table 5.

Table 5. Mohave Ground Squirrel Records in the Vicinity of the Rand Project Area

Location	App. Distance from Project Site	Source(s)
T30S,R40E,S1	0-1 miles	Brown (pers. comm.)
T29S,R41E,S27	3 miles	Aardahl and Roush (1985)
T29S,R41E,S26	4 miles	Aardahl and Roush (1985)
T29S,R41E,S31	4 miles	Aardahl and Roush (1985)

3.4 RESULTS OF SURVEYS FOR SENSITIVE PLANTS AND WILDLIFE

3.4.1 Sensitive Plants

No federally listed, State listed or Federal candidate plants species were found during surveys of the Rand Project. None have been recorded during inventories of the area for prior projects (McMains 1987, Rado 1991b, 1992). Neither the Mojave fishhook cactus nor the Charlotte's phacelia were located during these surveys. The Mojave fishhook cactus has a widespread but spotty distribution in the Mojave Desert. The Charlotte's phacelia is locally present along the western fringe of the Mojave Desert, near the base of the Sierra Nevada Range. Microhabitats favored by the Mojave spineflower and Kern tarplant are not present in the Rand Project area.

3.4.2 Wildlife

A single federally and State listed species, the desert tortoise, was located during project surveys. Another listed species, the State threatened Mohave ground squirrel, has been previously observed on the site (Dr. Patricia Brown, pers. observ.). Five California Species of Concern, the prairie falcon, barn owl, golden eagle, northern harrier, and Townsend's big-eared bat have also been recorded. Each listed species is discussed separately below. Information on the occurrence of several other non-listed sensitive species that were observed during surveys is also provided.

Desert Tortoise

Desert tortoises and sign were widely distributed over the survey area, but somewhat "clumped" in distribution. The majority of desert tortoise observations of live animals and sign were within a small valley encompassing portions of 2, 3, 10, 11 and 12 of Township 30 south, Range 40 East. A total of 12 live animals were observed in this area. Distribution of live tortoises was disproportionately "clumped" along a low ridgeline bordering the southern portion of the project boundary.

Lesser amounts of sign were located within an extensive area of hilly terrain on the northern slope of the Rand Mountains, encompassing portions of Sections 34 and 35 of Township 29 South, Range 40 East, and portions of Section 3 of Township 30 South, Range 40 East. A disproportionate number of desert tortoise carcasses (77% of total) and skeletal fragments (89% of total) were observed in this area. The number of dead animals observed was also extremely disproportionate to the number of live animals (7% of total) and burrows and pallets (16% of total). Many carcasses had the tops of the carapace peeled off, indicating death by predation. No chipping or tooth marks on the marginals were present that would have indicated death or scavenging by canids such as coyotes. The occurrence of most of these carcasses either on a hilltop, ridgeline, or in a steep slope below these suggested an avian predator such as a golden eagle. A pair of eagles that are known to prey on adult desert tortoises has been reported from the spine of the El Paso Mountains (BLM files), approximately four miles west of the location of those tortoise carcasses found during the current survey of the Rand Project. Although not conclusive, it is possible that those animals exhibiting signs of predation were killed by eagles. These animals may also have been imported onto the site from lowlying, higher-density areas in Fremont Valley.

No desert tortoises or sign were located during surveys in portions of Section 35 of Township 29 South, Range 40 East, and portions of Section 3 of Township 30 South, Range 40 East. A map showing locations of all animals observed and sign is provided in Appendix A. A total of 15 live tortoises, 22 carcasses (including disarticulated animals), 9 skeletal fragments, 89 burrows and pallets (including collapsed pallets) and 16 scat were observed during the survey. All live tortoises observed appeared to be in good health, with no sunken eyes or loose folds indicating dehydration. No caked nostrils, watery eyes or nasal mucus denoting Upper Respiratory Disease Syndrome (URDS) were noted. Survey results suggest that tortoise densities are higher in the valley region west of the Baltic Project area than at the Baltic site, where desert tortoises and sign were also located (Rado 1992), but lower on the steep hillslopes north of Government Peak.

Survey results are provided summarized in Table 6. Information on individual tortoises and sign are summarized in Appendix B. A detailed map showing specific locations of observed tortoises and sign is also provided in Appendix B.

Table 6. Summary of Desert Tortoises and Sign Observed During Survey of the Rand Project Area

Sign	# Observations
Live Tortoises	15
Tortoise Carcasses	31*
Burrows and Pallets	89
Scat	16
Total Adjusted Sign	131

*Includes Isolated Skeletal Fragments

Mohave Ground Squirrel

No Mohave ground squirrels were incidentally observed during intensive site surveys conducted over a six-week period. The species has been observed within the Baltic Project boundary during 1992 (Dr. Patricia Brown, pers. comm.), and is recorded from the vicinity of Johannesburg and Red Mountain near the project site (Aardahl and Roush 1985, CNDDDB records).

Consistent with survey protocols established by the CDFG, Mohave ground squirrel Cumulative Human Impact Evaluation Forms have been completed for the project area. Completed forms are being provided to the CDFG for review.

Other Sensitive Wildlife Species

No other listed wildlife species were observed or are expected to occur within the Rand Project area. A single prairie falcon was observed foraging near the peaks of a large rocky hill in the project area (T30S,R40E,S2) during transect surveys. No prairie falcon or other raptor eyries/nests were located on the project property during site inventories. Brown (1992) has located several barn owls during inspections of open shafts on the Baltic Project site. Observations included one abandoned barn owl nest with 10 eggs. On this basis, the barn owl opportunistically utilizes tunnels and shafts that predominate throughout the area for nesting and for refuge.

McMains (1987), during a survey of the current Baltic Project area (T30S,R40E,S1+6), recorded a LeConte's thrasher. Although none were observed during the current survey, the species may be expected to be distributed in drainages and valley floors within the project area.

Rado (pers. obs.) has observed a northern harrier in the vicinity of the Baltic Project (T30S,R40E,S1). This species may be expected as an occasional visitor to the general area during the winter

months. No harriers were observed during the current survey.

Rado (pers. obs.) has previously observed foraging golden eagles in this portion of the Rand Mountains and adjacent Fremont Valley. The species utilizes the general area for foraging, and is known to nest in the El Paso Mountains, approximately 5 miles west of the Rand Project boundary (BLM records). No golden eagles were observed during the current project survey.

Townsend's big-eared bats have also been recorded from abandoned mine shafts in the immediate vicinity of the project area, during a clearance survey of selected shafts and tunnels within planned mining development sites (Brown 1992). There are numerous additional shafts and tunnels scattered throughout this portion of the Rand Mountains that also provide roosting sites for this and other bat species.

4.0 ANTICIPATED PROJECT EFFECTS AND PROTECTION MEASURES

4.1 INTRODUCTION

The Rand Project will directly and indirectly affect constituent plants and wildlife present on the project site. A maximum of 1,020 acres of currently vegetated creosote bush scrub habitats will be lost as a consequence of mining and associated actions (roads, facilities, ore processing sites, etc.). Plants present within this area will be destroyed from blading or crushing. Wildlife species may be subject to injury, mortality, or displacement. Specific effects of proposed project actions on wildlife and vegetation are discussed in more detail in the following two sections.

4.2 IMPACTS

4.2.1 Habitat Disturbance

Habitats present within the Rand Project boundary will be destroyed or damaged within a maximum of 1,020 acres as a result of the following actions: (1) initial blading of vegetation within proposed mine, ore processing, facility, or access road areas; (2) crushing or damage to adjacent vegetation as a consequence of equipment use, stockpiling of ore and other materials, parking of vehicles, or driving of equipment; (3) exploration activity; (4) stockpiling of excavated spoils rock during mining; and (5) use of graders or other equipment to recontour surface profiles during reclamation. The loss of these habitats will not occur immediately, but incrementally, as mining expansion from an initial start-up expands, with concomitant use of ore processing facilities. The actual amount of habitats that will be disturbed over the projected nine-year lifespan of the project will not exceed 1,020, and may be lower, depending upon project economics and project design (Steve Stiller, Rand Mining Company).

Vegetation present within these areas will be damaged or destroyed as a consequence of those activities mentioned above through direct removal, crushing, soil compaction, or root damage. An overview of acreage that will be affected by proposed project activities under projected maximum development is provided in Table 1.

Timing of restoration will vary with project duration; plant species affected; climatic conditions; and effectiveness of reclamation measures. However, the duration of time following project shutdown for vegetation to significantly return to the mining sites is expected to exceed several decades.

4.2.2 Effects to Wildlife

Wildlife species will be subject to direct mortality from crushing or entombment in burrows, or indirectly from stress or predation resulting from displacement into offsite areas. Additional animals may be subject to injury or mortality when crossing roads utilized by project vehicles and equipment or from predation by avian predators such as ravens that may be attracted to the site. Individual animals may also be subject to drowning within ponds used for recycling/storage of waters used during ore processing, or from crushing, injury or displacement during exploration actions. Home ranges of species that are adjacent to actively mined sites may be fragmented from such development, restricting movements of individual animals. Nocturnal species may also be subject to stress associated with night lighting and/or constant mining activity.

Nesting birds may also be subject to displacement or harassment as a consequence of increased human presence and associated noise levels. The project will result in the incrementally small loss of raptor foraging habitat over this portion of the Mojave Desert. Filling/excavation of old mine shafts and tunnels within the project area could adversely affect nesting barn owls and several species of bats. Previously documented near the project site, the Federal candidate Townsend's big-eared bat could utilize shafts in the project area for refuge. This impact is not considered significant, providing that mitigation measures discussed in this biological assessment are implemented as a part of the mining project.

The potential for vehicle-related injury to wildlife will include not just the mining site, but the surrounding areas used by mining employees to commute to the site. This increased risk is judged to be low due to the small number of additional employees (8) projected to be added to the existing company payroll as a consequence of the Rand Project.

Individual animals, particularly birds or bats, may come into contact with cyanide solution during ore processing/metal

extraction. The ingestion of cyanide solution would lead to death. Although cyanide is actively used as a part of the project, stringent requirements mandated by the Rand Mining Company by regulatory agencies governing the containment and use of toxic materials, significantly reduce this potential.

Project area effects to wildlife will be long-term in duration, extending for years beyond the active development phase of the project. Over a protracted period of time covering decades, wildlife species will eventually return to the disturbed portions of the project area as human uses diminish and vegetation gradually begins to reestablish.

4.2.3 Incidental Take of Listed Species

Two listed species, the desert tortoise and Mohave ground squirrel, may be subject to take (e.g., killing, harming or harassment) during project activities. Individual animals may be subject to both direct and indirect effects during mining. Animals may be accidentally crushed or entombed in burrows, killed while crossing roads leading to mining sites, crushed by equipment during mining or ore processing activities, or may fall into open pit or trench segments and die from exposure, injury, or subsequent burial. Individual animals may drown after falling into site ponds used for storage of water used during ore processing. Additional animals may be displaced into adjacent undisturbed habitats as a consequence of habitat alteration, noise, ground vibration or other causes. Such displacement may increase intra-specific stress with offsite animals outside of the direct construction corridor.

The potential for the incidental take of each species is expected to remain highest during site preparation, and lower following creation of ore processing sites and construction of facilities and access roads. The effects to each species, however, will last for that duration of time that it takes disturbed habitats to revert to pre-project condition. These effects stem from reduction of food and cover associated with vegetation disturbance. Based on the intensity of planned development, involving both the blading of surface soils and their subsequent removal and major modification of soil profiles and ground contours, the duration of time for site restoration is expected to exceed several decades.

The exact numbers of each species that will be subject to take are difficult to quantify. Estimates of take for each species are provided as follows:

Desert Tortoise: Initial surveys have documented the presence of 15 individual desert tortoises within the project area. Additional animals may have home ranges that may intersect portions of the project area, or may wander on to the project area over the extended life of the project (9 years). On this basis, an estimated minimum of 20 individual desert tortoises could be

encountered within the Rand Project during project activities. Many of these can be safely moved and relocated to offsite areas prior to onset of ground-disturbing activities. Extrapolating from BLM-generated data (0-20 tortoises per square mile over 1,020 acres potentially subject to disturbance in the project area) provides an alternate estimate of between 0-32 tortoises currently present.

Estimating individual animals that may have to be removed from the project and burrows and pallets requiring excavation is more difficult to quantify. However, based on field inventory results, a total of 89 burrows and pallets were present within the project area. Not all of these burrows and pallets were located within areas slated for project development and the current survey results do not foretell numbers of future desert tortoise burrows and pallets that may be excavated by on-site animals, their progeny, or animals that move on to the project site from adjacent areas. However, many would require excavation during preactivity surveys as a precautionary measure to minimize any potential for desert tortoise injury or mortality during site-disturbing activities. A rough estimate of 40-50 desert tortoise burrows and pallets may require such excavation during the project nine-year lifespan of the Rand Project.

Mohave Ground Squirrel: There are no reliable density estimates for Mohave ground squirrels within the Rand Project boundary or adjacent areas. The species potentially occurs those portions of the site that are currently vegetated and subject to project-related disturbance, since the project is well within the estimated geographic range (Wessman 1977) and the species has been observed in the immediate project area (Patricia Brown, pers. observ.). Assuming an average density of 15-20 per square mile (Burt 1936), between 24 and 32 individual Mohave ground squirrels could be present within that 1,020-acre portion of the project site slated for mining development. This number underrepresents the actual number of animals that may be encountered, due to the multi-year operational life of the project. Additional animals may have home ranges that overlap project roads, leach pads, pits, or facility areas.

4.2.3 Impacts to Other Sensitive Species

General effects to non-listed species that have been located during project surveys and/or may occur within the Rand Project will be similar to those previously described for listed species. Each is discussed briefly below.

LeConte's Thrasher: Proposed project construction will result in the incremental disturbance to habitat used by the LeConte's thrasher. Effects associated with project activities are not considered to be significant for this species.

Prairie Falcon/Northern Harrier/Golden Eagle: Proposed mining activities will reduce the foraging habitat used by these and other area raptor species. This impact is not considered significant due to the large expanses of desert present throughout the region. No raptor nests were identified during the current survey or have been located during prior inventories.

Barn Owl: Closure of abandoned shafts and tunnels that provide barn owls nesting and cover sites will adversely affect this species. The effects associated with this action can be mitigated through implementation of measures detailed below.

Townsend's Big-eared Bat: Closure of shafts and tunnels within the project area may affect this species. The effects associated with this action can be mitigated through implementation of measures detailed below.

4.2.4 Cumulative Effects

Proposed mining operations from the Rand Project will affect two species of listed wildlife, the desert tortoise and Mohave ground squirrel. The effects associated with this project are restricted to incrementally small portions of the geographic ranges of each. However, on a range-wide basis, projects that may be insignificant individually, cumulatively result in the widespread degradation and fragmentation of listed species habitats and the loss of numbers of individual animals.

Impacts cumulatively influencing the Mohave ground squirrel and desert tortoise include road construction, urban development and associated uses, agricultural development, grazing, utility line construction, off-road vehicle recreation, and mineral exploration and development. Besides mining, individual projects that cumulatively effect Mojave Desert listed species include:

- Widespread seasonal grazing by domestic sheep in the western Mojave Desert, where sheep directly compete for seasonally available forage also important to the Mohave ground squirrel and desert tortoise (e.g. Cantil Common Allotment);
- Heavy vehicle use on existing and planned highway systems and arterials, that fragment habitats, isolate populations, and increase population declines through road mortality (e.g. Hwys 14 and 395);
- Urban population growth, with attending refuse and development, that enhances perching and feeding areas for common ravens, a major predator on desert tortoises (e.g. Mojave/Rosamond expansion);
- Utility line construction, that also increases available

- nesting and perching opportunities for ravens and other tortoise predators (e.g. Kramer-Silver Lakes 220 KV line);
- Agricultural development, that permanently modifies large tracts of extant wildlands, fragments existing wildlife populations, results in watertable drawdown, and encourages associated urban expansion into otherwise large contiguous blocks of native habitats (e.g. alfalfa production in the Fremont Valley).
- Off-highway motorized vehicle recreation, both individually and in organized racing and enduro events that are authorized in portions of the Mojave Desert (e.g., Johnson Valley Open Area).

The effects of these activities collectively are being addressed in two fashions: (1) through the development of a Recovery Plan for the desert tortoise, required by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973, as amended; and (2) development of a western Mojave Desert management plan focusing on the desert tortoise and Mohave ground squirrel. Plans for each area will seek to balance protection goals for species and associated habitats with development needs of the regional human population. Additionally, the Rand Mountains/Fremont Valley Management Area Plan has been prepared for the U.S. Bureau of Land Management to address ongoing human uses and protection of sensitive biological resources within a 63,020-acre portion of the Rand Mountains and Fremont Valley (BLM 1990) that includes portions of the Rand Project area.

4.3 PROTECTION MEASURES

4.3.1 Protection

The following protection measures have been developed to reduce potentially adverse effects associated with proposed Rand Project actions on listed and sensitive plants and wildlife:

1. Prior to undertaking any project actions, Rand Mining Company shall contact the U.S. Bureau of Land Management, Ridgecrest Resource Area Office, to discuss the timing of initiating formal consultation pursuant to Section 7 of the Endangered Species Act. The BLM, as a Federal agency involved as an "authorizing" agency for this project, is required to consult with the U.S. Fish and Wildlife Service, since the desert tortoise will likely be affected by proposed project actions. The Biological Opinion subsequently issued to the BLM from the USFWS, can legally take up to 135 days from receipt of request by the BLM. A section of the Opinion will establish a lawful limit of "take" for this species and set forth Terms and Conditions under which take may be permitted during mining activities. The Service may also require additional measures to protect

the desert tortoise during planned project actions. The appropriate agency contact is:

Mr. Lee Delaney
U.S. Bureau of Land management
Ridgecrest Resource Area Office
300 South Richmond Road
Ridgecrest, California 93555
(619/375-7125)

2. Prior to undertaking any project actions, Rand Mining Company shall also contact the CDFG to discuss permitting requirements and timeframes. Agency contacts are:

Mr. George Nokes
California Department of Fish and Game
Region IV Office
1234 E. Shaw Avenue
Fresno, California 93710
Attn: Dr. Jeff Single (209) 222-3761

3. During mining and related construction, stockpiling of equipment and vehicles shall utilize those portions of the project site that will be subject to permanent disturbance, or to areas subject to impact as a result of prior human use. Temporary or inadvertent disturbance to remaining portions of the area will be minimized by: staking, "flagging", or otherwise clearly marking the boundaries of the mining area; notifying employees of the specific areas, boundaries of the areas, and the need to avoid disturbance to remaining areas; and posting signs or erecting temporary fencing at access points to limit access to authorized vehicles and equipment only.

All employees shall be instructed that their activities shall be confined to locations within flagged or marked areas.

The area of disturbance shall be confined to the smallest practical area, considering topography, placement of facilities, locations of sensitive species, public health and safety, and other limiting factors. Special habitat features, such as tortoise burrows, identified by the authorized biologist, shall be avoided to the extent possible. To the extent possible, previously disturbed areas within the project area shall be used for the placement of equipment, work staging sites, or parking of vehicles.

4. Existing routes of travel already present through the project site shall be used during mining activities to the maximum extent practical in order to minimize any

disturbance to desert tortoise and Mohave ground squirrel habitats not slated for development. Speed limits on unposted access roads leading to and from the mining site, ore processing areas, equipment stockpile or overburden areas, and facilities will not exceed 25 miles per hour. Project-related work will be confined to designated routes.

5. Trash and food items will be promptly contained and regularly removed from the mining site to reduce attractiveness to opportunistic predators such as ravens or coyotes that prey on tortoises.
6. Mining activities will prevent increased erosion patterns and modification of down-slope habitat composition.
7. Domestic dogs will either be restrained or prohibited from the project site. These can be significant causes of wildlife mortality.
8. Firearms shall be prohibited from the project site during operations.
9. The U.S. Bureau of Land Management, Ridgecrest Resource Area Office, shall be notified in advance of any planned exploration activities. The BLM will be provided the opportunity to review planned exploratory actions and provide specific measures to protect sensitive species and associated habitats. During exploratory activities, including temporary excavation of trenches or holes, escape ramps consisting of loose earth deposited in the test hole or trench will be placed to facilitate the escape of any wildlife species that may inadvertently become entrapped. Such trenches or holes will also be inspected for entrapped wildlife prior to onset of activities and immediately prior to the end of each working day. A final inspection will also be made immediately before filling these holes or trenches. Any animals discovered will be allowed to escape before activities resume or carefully removed from the pit or trench and allowed to escape.
10. During placement of the associated waterline, mitigation measures 1-11, 15, 16, 19, 22 and 23 detailed in this section shall also be followed.
11. Prior to onset of mining activities, all employees will be required to take an endangered species education program. The program shall include information on the biology of listed species and their occurrence in the project area, measures being implemented for the protection of these species and their habitats during project activities, and means by which individual employees can facilitate this process.

The employee education program must be received, reviewed, and approved by the BLM, CDFG, and USFWS at least 15 days prior to the presentation of the program. The program may consist of a class or video presented by a qualified biologist. Wallet-size cards with important information for workers to carry are recommended. All employees shall participate in the education program prior to initiation of construction activities. The Company is responsible for ensuring that the education program is developed and presented prior to conducting activities. New employees shall receive formal approved training prior to working on-site. The program shall cover the following topics at a minimum:

- Distribution of listed and candidate species
 - General behavior and ecology of these species
 - Sensitivity to human activities
 - Legal protection
 - Penalties for violation of State and Federal laws
 - Reporting requirements
 - Project mitigation measures
12. Rand Mining Company will designate a specific individual that will serve as a "contact" representative between the company and regulatory and reviewing agencies associated with desert tortoise mitigation and compliance procedures. Written notification of this individual will be provided to the BLM, USFWS, and CDFG.
13. In order to minimize any exposure risk to desert tortoises, a specially designed fence will be constructed around all portions of the Project that will be permanently disturbed. Fence design must be discussed with and found acceptable to the USFWS, BLM, and CDFG. The following design suggestions are provided at this time:
1. the fence should be minimally 3 feet in height above ground level;
 2. fence design should have either 3-strand barbed wire or hogwire (the latter is recommended);
 3. the bottommost 1.5 feet of fence should have 1/2 inch mesh hardware cloth or other suitable material affixed;

4. the hardware cloth should be affixed to this fence at intervals not to exceed one foot using hog rings or other clamping devices;
5. the uppermost portion of the hardware cloth should not extend more than two inches above the lowermost wire strand if barbed wire is used;
6. this mesh should be buried to a depth of 1 foot below ground; OR
the bottom 1 foot should be bent at a right angle towards the outside of the fence, and covered with gravel or rocks to prevent animals from burrowing under the fence;
7. T-posts or other suitable anchoring posts should be placed at appropriate intervals (usually 10-16 foot spacing);
8. treated "peeler" posts or other suitable anchoring devices should be placed at appropriate intervals to ensure fence stability;
9. the protective fence should be regularly inspected and repaired; and
10. gates should be installed at appropriate access points that each provide sufficient minimal ground clearance to deter ingress by tortoises.

After fence installation, the authorized biologist shall conduct a complete survey for desert tortoises within the fenced area. All tortoises found shall be marked and removed from the enclosure to a location acceptable to BLM. The authorized biologist shall be allowed some discretion to ensure that survival of such tortoises removed is likely.

Tortoises removed from any fenced area shall be marked for future identification. An identification number using acrylic paint/epoxy covering shall be placed on the fourth left costal scute. 35-mm photographs of the carapace, plastron, and fourth left costal scute shall be taken. No notching is authorized.

14. Only a biologist authorized by the USFWS and CDFG shall handle a desert tortoise. Rand mining Company shall submit the names of all proposed authorized biologists to the USFWS and CDFG for review and approval at least 30 days prior to onset of activities. No project activities shall begin until an authorized biologist is approved.

Authorization for tortoise handling will be granted by USFWS under the auspices of the Section 7 Biological Opinion for the project. Authorization for handling tortoises will be granted by CDFG under a Memorandum of Understanding between this agency and the biologist.

15. Within 24 hours prior to onset of any buildout on the site as a consequence of mine expansion activities, a pre-activity survey shall be undertaken to locate tortoises, burrows, and pallets. Those tortoise burrows located within the project area which cannot be avoided shall be excavated by hand during this time period. All excavation of desert tortoise burrows shall be in accordance with the desert tortoise handling procedures developed by the USFWS. Measures will be taken to prevent tortoises from occupying the burrow sites. Burrows will be excavated and tortoises handled only by authorized biologists.

(A) All tortoises which are found on the project site, whether above ground, in excavated burrows, or in an open trench, shall be placed 300 to 1000 feet outside of the project boundary in the direction of undisturbed habitat. Tortoises shall be placed in the shade of a large, marked shrub. Each tortoise found within three hours of nightfall or when ambient temperatures exceed 90 degrees Fahrenheit shall be placed in a clean disposable cardboard box and held overnight in a cool location. The box shall be covered and kept in the possession of a designated biologist for release of each tortoise the next morning in a manner described above. New disposable latex gloves shall be used to handle all tortoises, used once, and discarded. All materials which come into contact with tortoises shall be used only once and then properly discarded to minimize contact with the causative factor(s) for Upper Respiratory Disease Syndrome. Tortoises shall be kept upright at all times and handled in a secure but gentle manner to minimize stress including the possibility of voiding the bladder.

(B) The authorized biologists shall maintain a record of all desert tortoises encountered during project activities. This information shall include for each tortoise:

1. The locations and dates of observation;
2. General condition and health, including injuries and state of healing and whether animals voided their bladders;
3. Location moved from and location moved to; and
4. Diagnostic markings (i.e., identification numbers of marked lateral scutes).

These actions will require a permit from the USFWS and CDFG. Rand Mining Company shall contact both agencies regarding permitting requirements.

16. Tortoises commonly seek shade during the hot portions of the day. Employees shall be required to check under equipment and vehicles prior to moving such.
17. Nets or other suitable coverings shall be placed over all ponds containing toxic solutions to prevent contact with area wildlife species. These shall be regularly inspected and maintained by Rand Mining Company for the duration of the project.
18. In order to protect roosting bats and nesting birds such as barn owls that may opportunistically utilize old shafts and tunnels subject to destruction from mining actions, the following measures shall be applied:
 - (A) The mine shafts and tunnels subject to destruction shall be initially inspected by a qualified biologist (e.g., a biologist familiar with these species, their habits, and appropriate survey techniques) to determine whether bats or birds are utilizing such sites.
 - (B) The inspection shall be made at a time favorable for the observation of such species by the biologist.
 - (C) Where nesting owls or bats with young are located, the closure of the pit or shaft shall be delayed until the young animals have matured and/or have independently left the shaft or tunnel. Timing of such shall be determined by monitoring by the subject biologist.
 - (D) Where adult birds and bats are located, the biologist shall monitor the subject mine shaft or tunnel until the animals have voluntarily left. The shaft or tunnel shall then be either securely covered with netting or other suitable materials, or shall be filled to prevent future use by these animals.
 - (F) Where the qualified biologist conducting shaft and tunnel inventories does not locate any wildlife in the subject shaft or tunnel, this shaft or tunnel shall be securely covered with netting or other suitable materials or shall be filled immediately following this observation by the biologist to

prevent future use by wildlife.

19. No later than 90 days after completion of pre-activity surveys discussed in #14 above, Rand Mining Company and the authorized biologist (company) shall prepare a report for the BLM, CDFG, and FWS. The report shall document the effectiveness and practicality of the protection measures for listed and sensitive species, the numbers and locations of such species encountered and their disposition. The report shall also provide recommendations for modifying these protection measures to enhance protection of such species or to make their implementation more workable to the company. The report shall provide an estimate of the actual acreage disturbed by the operation.
20. Toxic materials contained on the site shall be stored and used in a manner that prevents harm to desert tortoises and other wildlife species.
21. Stockpiling of ore and tailings will maximize use of previously disturbed areas.
22. Upon locating a dead or injured listed species, the operator (Rand Mining Company) shall notify the BLM. The BLM shall then notify the appropriate field office (Ventura or Sacramento) of the USFWS within three days of the finding. Written notification must be made within 15 days of the date and time of the finding or incident (if known), location of the carcass, a photograph, cause of death (if known), and other pertinent information. The remains shall be collected and frozen as soon as possible. Injured animals shall be transported to a qualified veterinarian for treatment at the expense of Rand Mining Company. If an injured animal recovers, the USFWS shall be contacted for final disposition of the animal.
23. Upon completion of mining activities, all equipment and materials shall be removed from the project site and the site reclaimed according to an approved reclamation plan.

4.3.2 Compensation

The Proposed Project will result in the estimated long-term disturbance to a maximum of 1,020 acres of creosote bush scrub habitats. Recent surveys have not documented any desert tortoises or tortoise sign within 73 acres peripherally distributed within the project area along the northeastern boundary in Section 35 of Township 29 South, Range 40 East and within 58 acres in Section 3 of Township 30 South, Range 40 East, consisting of steep north-facing slopes of the Rand Mountains. Offsetting measures to compensate for project-related disturbance to remaining

acreage are discussed below.

Desert Tortoise

The BLM has developed the following formula for establishing appropriate offsets for project-related effects to desert tortoise habitats:

$$\text{Compensation Rate} = C + A + G + E + D,$$

Where,

- C = Tortoise Habitat Category
- A = Impacts on Adjacent Lands
- G = Growth-inducing Effects
- E = Level of Existing Site
Disturbance
- D = Duration of Effect

For impacts in Category III desert tortoise habitats, a compensation rate of 1.0:1.0 is automatically applied (e.g., the acquisition of 1 acre of tortoise habitat for each acre of tortoise habitat affected by the project). In this instance, a maximum amount of 1,020 vegetated acres will be affected. Approximately 131 acres of this total is judged not to be tortoise habitat for reasons described above. Remaining acreage consists of tortoise habitats containing live tortoises and widely scattered burrows and pallets south of Government Peak, and marginal tortoise habitat containing few burrows and pallets west of Government Peak. The exact acreage affected will depend upon the final design and siting of the project facilities. It is estimated that well under the estimated 1,020 acres of currently vegetated habitats on the project site will be ultimately affected (Steve Stiller, Rand Mining Company, pers. comm.).

The project facilities will be constructed in phases, each phase being constructed approximately every two years. Compensation will be made on the basis of 1.0 acre of acquired (e.g., compensatory) tortoise habitats for each acre of tortoise habitats affected by the project. The compensation will be accrued on the basis of phased development on the project property, with the acreage of lands acquired as compensation being financially assured prior to the start of construction for each project phase. The actual deeding of the property will occur within one year from the start of each project phase.

Therefore, Rand Mining Company shall acquire compensatory desert tortoise habitat in a ratio of 1:1 for each acre of tortoise habitat affected by the Rand Project. These

acquired tortoise habitats shall be secured at a location acceptable to the BLM, CDFG, and USFWS. Such acreages shall be conveyed in title to an entity mutually acceptable to the BLM, CDFG, and the USFWS. Lands so secured shall be protectively managed for the desert tortoise.

The Rand Project lies within the boundary of an area that is being addressed within the West Mojave Coordinated Management Plan. This plan is currently being developed and is not available for review. In such event that current measures to offset project-related impacts to desert tortoise habitats during the Rand Project are inconsistent with those that are developed and presented within the West Mojave Coordinated Management Plan, Rand Mining Company shall contact the U.S. Bureau of Land Management for further guidance.

5.0 CONCLUSION

The Rand Mining Company proposes to expand its existing operations near the community of Randsburg over the next nine years. The project will, under maximum proposed development, result in the modification of 1,020 acres of creosote bush scrub habitats from creation or expansion of mine pits, waste rock piles, ore processing areas, roads, and associated facilities. Surveys of the project area have verified the occurrence of two listed species, the Federal and State listed threatened desert tortoise, and the State listed threatened Mohave ground squirrel. Measures to protect these species associated with the long-term disruption of their habitats during mining development presented in this biological assessment shall be incorporated by the Rand Mining Company as project actions. These actions, in conjunction with the purchase and protective management of offsite lands of higher management value to both the Mohave ground squirrel and desert tortoise will not cumulatively reduce the likelihood of their eventual recovery and delisting by State and Federal agencies.

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APPENDIX A
LISTS OF PLANTS AND WILDLIFE OBSERVED IN RAND PROJECT AREA

TABLE A-1

Vascular Plants Observed Within the Rand Project Area, Kern County, California

Gnetae

Ephedraceae

Ephedra nevadensis
E. viridis

Mormon-tea Family

Nevada joint fir
mountain joint fir

Angiospermae

Dicotyledoneae

Apiaceae

Carrot Family

Lomatium mohavense

Mojave wild parsley

Asteraceae

Sunflower Family

Ambrosia acanthicarpa
A. dumosa
Coreopsis bigelovii
Encelia farinosa
E. pringlei
E. wallacei
Haplopappus acradenius
Hymenoclea salsola
Lasthenia californica
Machaeranthera tortifolia
Malacothrix glabrata
Pectis papposa
Syntrichopappus fremontii
Tetradymia stenolepis

annual bur-weed
burro bush
Bigelow's coreopsis
brittle-bush
Pringle eriophyllum
Wallace's woolly-daisy
goldenbush
cheesebush
common goldfields
Mojave aster
desert dandelion
chinch-weed
syntrichopappus
narrow-scaled felt-thorn

Boraginaceae

Borage Family

Amsinkia tessellata
Cryptantha nevadensis
C. pterocarya
C. utahensis
Pectocarya penicillata
P. setosa
Plagiobothrys arizonicus

checkered fiddleneck
Nevada forget-me-not
wing-nut forget-me-not
scented forget-me-not
hairy-leaved comb-bur
stiff-stemmed comb-bur
Arizona popcorn flower

Brassicaceae

Mustard Family

Descuraina pinnata
Erysimum capitatum
Thelypodium lasiophyllum
Tropidocarpum gracile
Caulanthus inflatus
Lepidium flavum

tansy mustard
western wallflower
California mustard
tropidocarpum
desert candle
yellow peppergrass

Cactaceae

Opuntia basilaris
O. echinocarpa

Capparaceae

Isomeris arborea

Chenopodiaceae

Eurotia lanata
Grayia spinosa
Salsola iberica

Euphorbiaceae

Chamaesyce albomarginata
Eremocarpus setigerus

Fabaceae

Astragalus didymocarpus
A. lentiginosus var. *variabilis*
Lotus humistratus
L. strigosus
Lupinus concinnus
L. microcarpus var.
horizontalis
L. odoratus
Psoralea fremontii

Geraniaceae

Erodium cicutarium

Hydrophyllaceae

Emmenanthe penduliflora
Phacelia distans
P. fremontii
P. tanacetifolia
Pholistoma membranaceum

Labiatae

Salazaria mexicana
Salvia columbariae

Loasaceae

Mentzelia affinis
M. albicaulis
M. eremophila

Cactus Family

beavertail cactus
silver cholla

Caper Family

bladderpod

Goosefoot Family

winter fat
spiny hop-sage
Russian thistle

Spurge Family

rattlesnake weed
dove-weed

Pea Family

dwarf locoweed
desert locoweed
hill lotus
stiff-haired lotus
bajada lupine
chick lupine
royal desert lupine
Fremont indigobush

Geranium Family

red-stemmed filaree

Waterleaf Family

whispering bells
fat-leaf phacelia
Fremont phacelia
tansy phacelia
white fiesta flower

Mint Family

bladdersage
chia

Loasa Family

yellow comet
small-flowered blazing star
shining stickseed

Malvaceae*Sphaeralcea ambigua***Nyctaginaceae***Mirabilis bigelovii***Onagraceae***Camissonia* sp.*C. claviformis**C. palmeri***Papaveraceae***Escholzia minutiflora***Polemoniaceae***Eriastrum* sp.*Gilia latiflora* ssp. *elongata**Gilia* sp. (poss. *transmontana*)*Linanthus dichotomus***Polygonaceae***Chorizanthe brevicornu*ssp. *brevicornu**Eriogonum deflexum**E. fasciculatum**E. inflatum**E. nidularium**E. pusillum**Oxytheca perfoliata***Portulacaceae***Calyptridium monandrum***Ranunculaceae***Delphinium parishii***Solanaceae***Datura meteloides**Lycium andersonii**L. cooperi***Zygophyllaceae***Larrea tridentata***Mallow Family**

desert mallow

Four-O'Clock Family

wishbone bush

Evening-Primrose Family

primrose

clavate-fruited primrose

Palmer's evening prirose

Poppy Family

little gold-poppy

Phlox Family*eriastrum*broad-flowered *gilia**gilia*

evening snow

Buckwheat Family

brittle spine-flower

skeleton weed

California buckwheat

desert trumpet

bird's nest

yellow turban

punctured bract

Purslane Family

sand-cress

Crowfoot Family

Parish's larkspur

Nightshade Family

Jimson weed

Anderson's thornbush

peach-thorn

Caltrop Family

creosote bush

Monocotyledoneae

Agavaceae

Agave Family

Yucca brevifolia

Joshua tree

Liliaceae

Lily Family

Brodiaea capitata pauciflora

desert hyacinth

Dichelostemma pulchellum

blue dicks

Poaceae

Grass Family

Bromus arizonicus

Arizona brome

B. rubens

red brome

B. tectorum

cheat-grass brome

Oryzopsis hymenoides

Indian ricegrass

Poa secunda ssp. secunda

pine blue grass

Schismus arabicus

Arabian schismus

Stipa speciosa

desert stipa

TABLE A-2

Vertebrates or Sign Observed Within the Rand Project Area, Kern County, California*

Reptiles

TESTUDINIDAE

desert tortoise

GEKKONIDAE

banded gecko

IGAUNIDAE

desert spiny lizard
zebra-tailed lizard
long-nosed leopard lizard
side-blotched lizard
desert horned lizard

TEIIDAE

western whiptail

BOIDAE

rosy boa

COLUBRIDAE

coachwhip
long-nosed snake
common kingsnake
gopher snake
glossy snake
western shovel-nosed snake
spotted leaf-nosed snake
night snake

VIPERIDAE

sidewinder
Mojave rattlesnake
speckled rattlesnake

TORTOISE FAMILY

Gopherus agassizii

GECKO FAMILY

Coleonyx variegatus

IGUANID LIZARD FAMILY

Sceloporus magister
Callisaurus draconoides
Gambelia wislizenii
Uta stansburiana
Phrynosoma platyrhinos

WHIPTAIL FAMILY

Cnemidophorus tigris

BOA FAMILY

Lichanura trivirgata

COLUBRID SNAKE FAMILY

Masticophis flagellum
Rhinocheilus lecontei
Lampropeltis getulus
Pituophis melanoleucus
Arizona elegans
Chionactis occipitalis
Phyllorhynchus decurtatus
Hypsiglena torquata

PIT VIPER FAMILY

Crotalus cerastes
Crotalus scutulatus
Crotalus mitchelli

Birds

FAMILY ACCIPRITRIDAE

red-tailed hawk
golden eagle
prairie falcon
northern harrier

HAWKS

Buteo jamaicensis
Aquila chrysaetos
Falco mexicanus
Circus cyaneus

FAMILY TYTONIDAE

great horned owl
common barn owl

FAMILY CAPRIMULGIDAE

lesser nighthawk

FAMILY COLUMBIDAE

mourning dove

FAMILY MIMIDAE

Le Conte's thrasher

FAMILY PICIDAE

common flicker

FAMILY EMBERIZIDAE

black-throated sparrow
white-crowned sparrow
house finch
western meadowlark
western tanager

FAMILY ALAUDIDAE

horned lark

FAMILY LANIIDAE

loggerhead shrike

FAMILY TYRANNIDAE

western kingbird
Say's phoebe

FAMILY CORVIDAE

common raven

FAMILY STURNIDAE

European starling

OWLS

Bubo virginianus
Tyto alba

GOATSUCKERS

Chordeiles acutipennis

PIGEONS AND DOVES

Zenaida macroura

THRASHERS

Toxostoma lecontei

WOODPECKERS

Colaptes cafer

**WOOD WARBLERS, ORIOLES,
SPARROWS**

Amphispiza bilineat
Zonotrichia leucophrys
Carpodacus mexicanus
Sturnella neglecta
Piranga ludoviciana

LARKS

Eremophila alpestris

SHRIKES

Lanius ludovicianus

FLYCATCHERS

Tyrannus verticalis
Sayornis saya

CROWS

Corvus corax

STARLINGS

Sturnus vulgaris

FAMILY TROGLODYTIDAE

cactus wren
rock wren

FAMILY PHASIANIDAE

chukar

WRENS

Campylorhynchus brunneicapillus
Salpinctes obsoletus

QUAIL

Alectoris graeca

Mammals**FAMILY VESPERTILIONIDAE**

western pipistrelle bat
California myotis
Townsend's big-eared bat

PLAINNOSE BATS

Pipistrellus hesperus
Myotis californicus
Plecotis townsendi

FAMILY CRICETIDAE

cactus mouse
deer mouse
desert woodrat

NEW WORLD MICE

Peromyscus eremicus
Peromyscus maniculatus
Neotoma lepida

FAMILY GEOMYIDAE

Botta's pocket gopher

GOPHERS

Thomomys bottae

FAMILY SCIURIDAE

Mojave ground squirrel
white-tailed antelope squirrel

SQUIRRELS

Spermophilus mohavensis
Ammospermophilus leucurus

FAMILY LEPORIDAE

desert cottontail
black-tailed jackrabbit

HARES

Sylvilagus audubonii
Lepus californicus

FAMILY HETEROMYIDAE

Panamint kangaroo rat
longtail pocket mouse

KANGAROO RATS/POCKET MICE

Dipodomys panamintinus
Perognathus formosus

FAMILY CANIDAE FOXES/DOGS/WOLVES

desert kit fox
coyote

Vulpes macrotis arcipes
Canis latrans

*Includes species not observed during current survey, but report from other biologists and previously recorded from prior site surveys (McMains 1987, Brown, pers. observ.)

APPENDIX B

DESERT TORTOISES AND TORTOISE SIGN OBSERVED DURING SURVEYS OF THE RAND PROJECT AREA

Table B-1. Desert Tortoises and Sign Observed During Surveys of the Rand Project Area

No.	Type of Sign	W	H	D	Comments
		(in)			
1	Burrow	6	6	14	poor condition, no other sign
2	Burrow	10	7	20	fair condition, no other sign
3	Burrow	12	8	42	poor condition, no other sign
4	Collapsed pallet				
5	1 Class IV Scat				
6	Burrow	12	6	?	tortoise (male = 250 mcl est.)
7	Collapsed pallet				
8	Collapsed pallet				
9	Burrow	7	14	?	tortoise (female = 260 mcl est.)
10	Carcass				large male (280 mcl) in old shaft (dead app. 1-2 years)
11	1 Class II scat				
12	Collapsed burrow				
13	Burrow	10	7	29	fair condition, no other sign
14	Burrow	9	9	58	fair condition, no other sign
16	Collapsed pallet				
17	Collapsed pallet				
18	2 Collapsed pallets				
19	Burrow	10	4	?	tortoise (female 220 mcl-est.)
20	Collapsed pallet				
21	2 Collapsed pallets				
22	Burrow	21	8	27	at edge of mine shaft/no sign
23	Burrow	13	9	14	no other sign
24	2 Collapsed pallets				
25	Burrow	8	6	23	fair condition, no other sign
26	Burrow	8	3	64	good condition, no other sign
27	Burrow	10	5	26	good condition, no other sign
28	Burrow	10	5	28	good condition, no other sign
29	Pallet	14	3	8	good condition, no other sign
30	Burrow	12	6	41	good condition/ 1 Class IV scat
31	Burrow	8	3	?	tortoise (sex ?/ mcl = 220 app.)
32	Pallet	10	5	10	fair condition, no other sign
33	Burrow	10	6	35	fair condition, no other sign
34	Burrow	12	6	?	tortoise (sex?/mcl 180 app.)
35	Burrow	10	6	56	fair condition, no other sign
36	Burrow	10	6	36	fair condition, no other sign
37	Collapsed pallet				
38	Burrow	11	7	30	fair condition, no other sign
39	Collapsed pallet				
40	Burrow	10	6	20	good condition, no other sign
41	Burrow	8	4	24	good condition, no other sign
42	Burrow	8	4	24	good condition, no other sign
43	Burrow	6	3	24	fair condition, no other sign

Table B-1. Continued

No.	Type of Sign	W	H	D	Comments
		(in)			
44	Burrow	8	5	36	good condition
45					(probable tortoise inside previous burrow)
46	Carcass				220 mm female/dead >5 years
47	Carcass				disarticulated male/dead over 5 years
48	Burrow	10	4	24	1 Class II scat, good condition
49	Burrow	12	7	20	good condition, no other sign
50	Burrow	10	5	24	good condition, no other sign
51	Burrow	10	6	18	good condition, no other sign
52	Pallet	9	5	10	fair condition, no other sign
53	Collapsed pallet				
54	Pallet	11	6	20	fair condition, no other sign
55	Collapsed pallet				
56	Burrow	13	9	24	tortoise (250 mcl) 15 ft from burrow (feeding) no URDS
57	Pallet	10	5	12	poor condition, no other sign
58	Pallet	12	6	20	fair condition, no other sign
59	Carcass				Adult female (dead over 3 yrs); killed by shotgun blast
60	Pallet	20	9	24	good condition, no other sign
61	Pallet	22	7	24	good condition, no other sign
62	1 Class III scat				
63	1 Class II scat				
64	1 Class IV scat				
65	Collapsed pallet				
66	Burrow	12	6	?	tortoise (male 220 mcl-est.)
67	Collapsed pallet				
68	Burrow	12	6	?	tortoise (female 260 mcl-est.)
69	Collapsed pallet				
70	Burrow	9	4	24	no other sign
71	Collapsed pallet				
72	2 Collapsed pallets				
73					Disarticulated carcass - dead over 5 years
74					Downslope portion of same carcass
75	1 Class III scat				
76	Carcass				Subadult (110 mm mcl) dead 2-3 years
77	Old scut bone fragment on woodrat midden (dead over 10 yrs)				
78	1 Class IV scat				
79	1 Class IV scat				
80	Disarticulated carcass (adult), no scutes, dead over 10 yrs				
81	1 Class IV scat				
82	Pallet	24	8	24	good condition, no other sign
83	Burrow	14	8	45	1 Class III and 1 Class IV scat
84	Burrow	6	4	?	tortoise (110 mcl) 10 ft from burrow/no sign URDS
85	2 Class V scat				
86	Disarticulated carcass, large adult, dead over 10 years				
87	Bone fragment, dead over 10 years				
88	Same				
89	Same				
90	Collapsed pallet				

Table B-1. Continued

No.	Type of Sign	W	H	D	Comments
		(in)			
91	Carcass	Subadult (120 mm), dead 1-2 years			
92	Disarticulated carcass,	dead over 10 years			
93	Bone fragment,	dead over 10 years			
94	1 Class II scat				
95	Bone fragment,	dead over 10 years			
96	Burrow	7	4	24	good condition, no other sign
97	Carcass	Subadult (120 mm), dead 1-2 years			
98	Burrow	14	8	36	good condition, no other sign
99	Bone fragment,	dead over 10 years			
100	Disarticulated carcass,	sex unknown, dead 2-3 years			
101	Carcass, adult female,	dead 4-5 years			
102	Disarticulated carcass,	subadult, dead over 5 years			
103	Plastron fragment,	dead over 10 years			
104	Pallet	12	6	14	good condition, no other sign
105	Pallet	12	6	10	fair condition, no other sign
106	Burrow	6	4	20	fair condition, no other sign
107	Burrow	12	6	16	fair condition
108	Collapsed pallet				
109	Carcass, male, 220 mcl,	dead 1-2 yrs/ carcass, 210 mcl			
	female,	dead over 5 years (same spot)			
110	Collapsed pallet				
111	Plastron fragment,	subadult, dead over 10 years			
112	Carcass, adult female,	dead over 5 years			
113	Carcass, large adult (disarticulated),	dead over 2 years			
114	Carcass, 200 mcl female,	dead 2-3 years			
115	Carcass, 220 mcl female,	dead 2-3 years			
116	Pallet	12	5	24	no other sign
117	Burrow	18	3	100+	good condition, well used
118	Carcass, disarticulated adult,	dead 5-10 years			
119	Carcass, adult male, 200 mcl,	dead 2-3 years			
120	Burrow	12	6	48	fair condition, no other sign
121	Burrow	15	6	36	fair condition, no other sign
122	Burrow	7	4	60	good condition, no other sign
123	Collapsed burrow				
124	Rock Burrow	12	8	48	fair condition, no other sign
125	Burrow	12	6	?	tortoise, 260 mcl male, no URDS
126	Burrow	8	5	?	tortoise, 200 mcl male, no URDS
127	Pallet	10	4	8	poor condition, no other sign
128	Pallet	9	4	6	poor condition, no other sign
129	Burrow	6	4	?	tortoise, female, 200 mcl,
130	Tortoise, subadult (male?),	120 mm MCL, no sign URDS			
131	Tortoise, subadult (sex unknown),	100 MCL, no sign URDS			

* Please refer to Appendix B for exact locations of tortoises, burrows and other sign observed during survey.

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APPENDIX C
RESUMES OF BIOLOGISTS

APPENDIX D

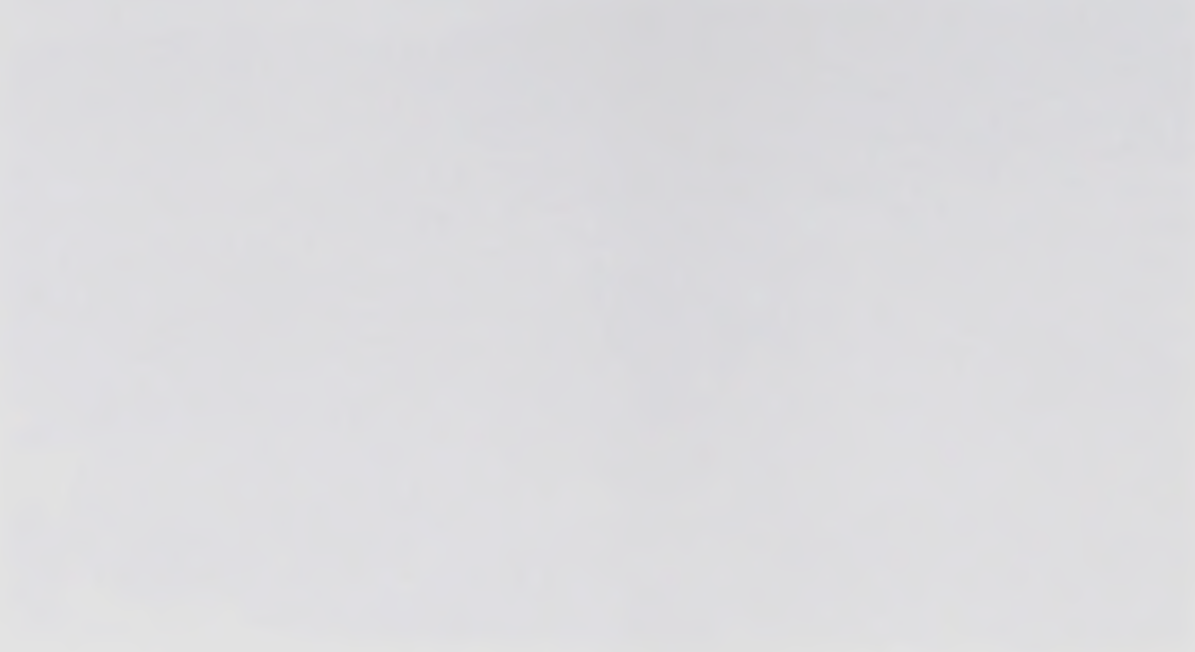
PHOTOGRAPHS OF PROJECT AREA



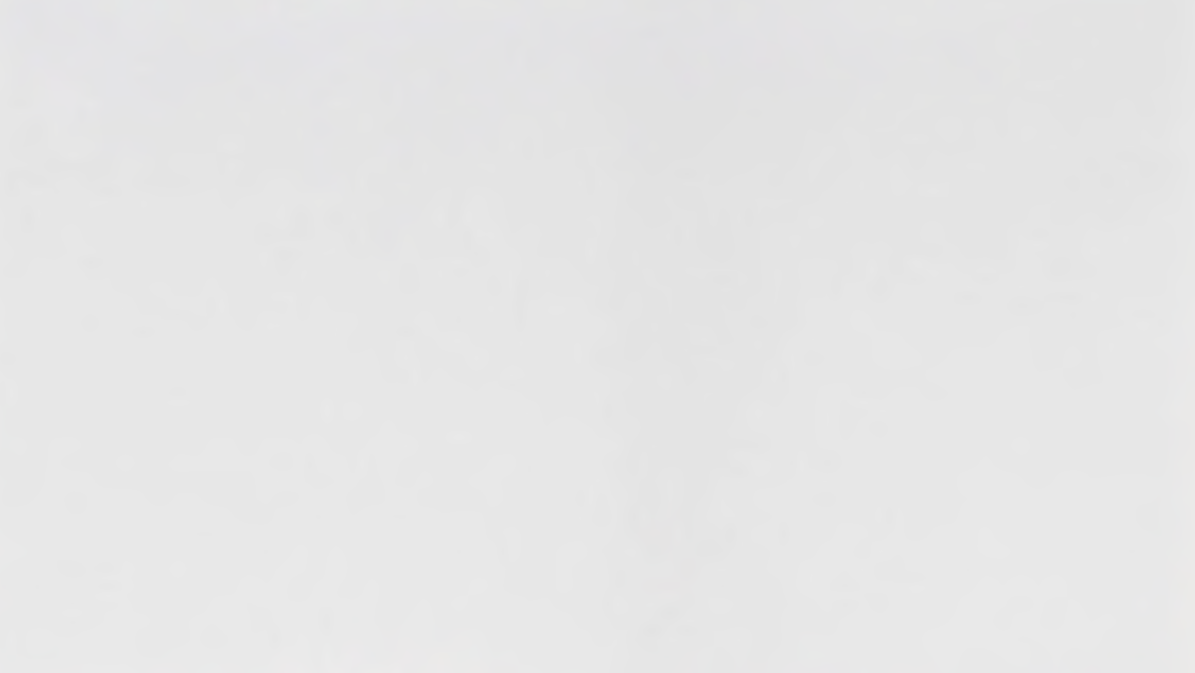
Low rolling hill country southwest of current mining activities. Majority of desert tortoises and sign located during survey of this area (T30S,R40E,S11).



Creosote bush scrub habitats, looking northeast towards Lamont Pit and ore processing area. Photo shows old mine shafts and tailings (foreground) that predominate throughout the area (T30S,R40E,S2).



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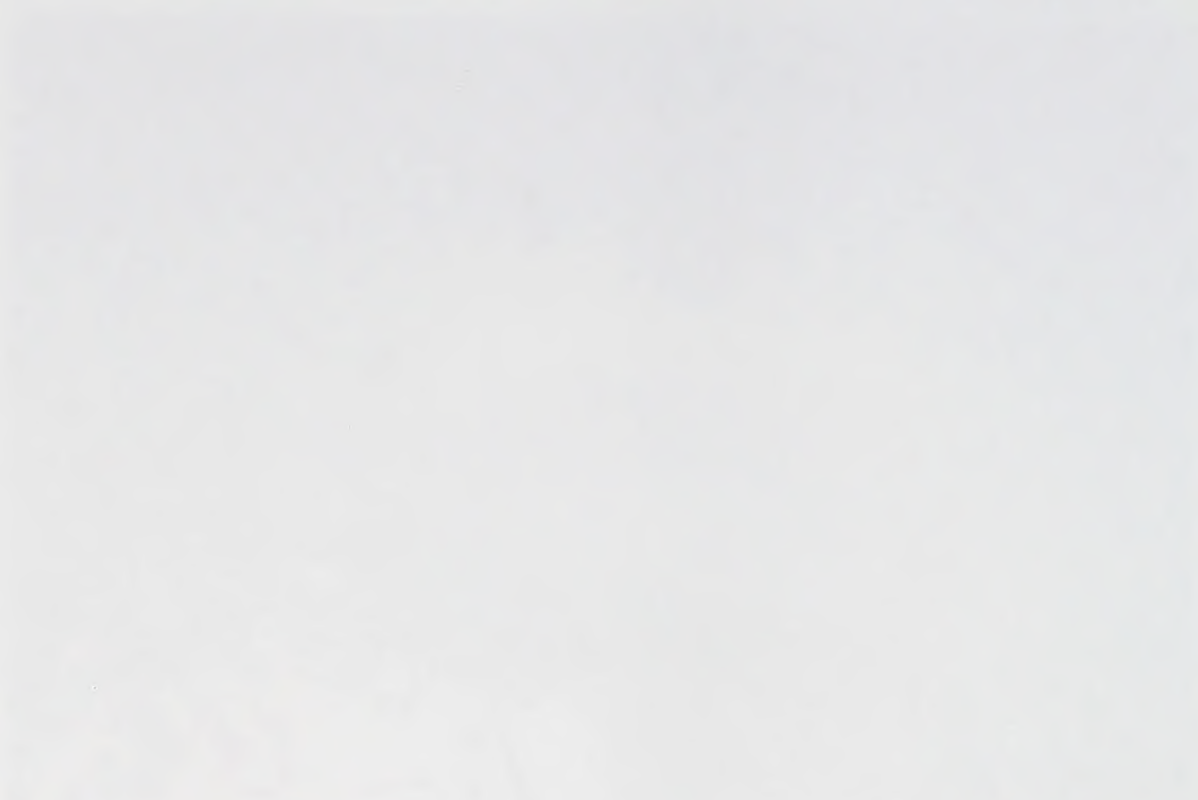
Series of steep hills and ridges on the northwest slope of the Rand Mountains northwest of the Yellow Aster Mine. Few tortoises and sign located during surveys of this area (T29S, R40E, S34).



Adult desert tortoise basking near burrow entrance (T30S, R40E, S2).



APPENDIX I

Bat Survey of Rand Project, Rand Mining District, Kern County

**BAT SURVEY OF RAND PROJECT, RAND MINING DISTRICT
KERN COUNTY, CALIFORNIA**

Prepared by

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INTRODUCTION

A field survey for bats was conducted on approximately 2520 acres of the Rand Project located in the Rand Mining District within Sections 1,2,3,10,11 and 12 of Township 30 South and Range 40 East and Sections 34 and 35, Township 29 South, Range 40 East, in the unincorporated area of Kern County, California. There are many historic mine workings in the area, most of which are in crushed and unstable earth.

Historic mines can provide refuge for bats and other wildlife, such as owls. Special attention was given in this survey to any signs of Townsend's big-eared bat (*Plecotus townsendii*), which is a U.S. Fish and Wildlife Service category 2 Candidate for Threatened or Endangered status and a California Department of Fish and Game Species of Special Concern. This species roosts traditionally in caves, but has moved into man-made "caves" such as buildings and mines, often in response to disturbance in natural caves. *Plecotus* are quite sensitive to human disturbance, and this appears to be the primary cause of population decline (Pierson, pers comm.). Unlike other bat species, they are reluctant to crawl into crevices, and usually roost in exposed areas, where they are vulnerable to disturbance. During the late spring and summer, maternity colonies of up to 200 individuals form. Great fidelity exists for a roost site, and if left undisturbed, the bats will use the same roost for many generations. In the winter, *Plecotus* hibernate in cool caves and mines. Hibernation is a critical time for the species, since any disturbance that causes arousal may expend energy reserves needed to survive the winter. The hibernation period in California will vary with ambient temperature, but is generally from late November through mid-March.

METHODS

The survey was conducted on 17 days between April 15 and August 10, 1993. Survey methods consisted of entering accessible mines during the day to look for bats, bat guano or other animals. For at least 90 minutes after dark, shafts that were not safe to enter were watched with night vision equipment to ascertain if any bats emerged. *Plecotus* flies slower and is more butterfly-like in comparison to the rapid movements of the smaller *Myotis*. A bat detector was used to monitor ultrasonic signals since many species emit distinctive sonar signals. Notes were made of any other animals encountered in the mines, such as barn owls (*Tyto alba*).

When no bats or owls were encountered, the mines were marked with pink flagging for closure with wire mesh by Rand Mining personnel as soon as possible in order to prevent animals from entering. Mines in which bats or owls had been seen were marked with blue flagging. Those mines will be watched for a second time at dusk in September or October, and wire mesh placed over the mines after all the bats and owls have exited.

RESULTS

The Rand historical survey map and the topographic map were used to locate the sites. The numbers given to the sites are based on the historical survey (Appendix I). A total of more than 130 mine openings were surveyed. Of these, 97 were able to be entered and 15 were monitored at dusk for bat emergence (3 of these were also entered). The remainder were not potential bat habitat because they were short shafts with no cross-cuts. Of the mines entered during the day, bat guano was noted in three of them (#72F, 102 F and 126), but no bats were seen. Of the mines watched at dusk, *Plecotus* exited from 6 mines (# 17D, 72F, 72K, 102J, 173 and south of 122) after dark, thereby indicating a diurnal roost. These results are shown in Table I. Small *Myotis* sp. (probably *californicus*) flew in and out of several of the mines after dark, such as shaft 72A. On some occasions bats entered the mines after dark, and then bats were observed to exit the same mine a few minutes later. It could not be determined whether these were the same individuals. The best estimate in these cases is to calculate the net bats roosting in the mine by subtracting those arriving from those departing. The possibility exists that the bats that enter the mine just after dark (possibly from a roost in another mine or rock crevice), might remain in the mine some time and are not the same bats that exited within the hour. This would then tend to underestimate the number of resident mine bats. In addition to the bats exiting the mines, western pipistrelles (*Pipistrellus hesperus*) were seen at dusk and their echolocation signals detected with the bat detector. These small bats roost in rock crevices and can inhabit mines. Pallid bats (*Antrozous pallidus*), a CDFG Species of Concern, also roost in crevices in granite boulders and could occur on the site. They often emit a distinctive communication sound when flying near a roost. This sound was heard at dusk on June 13 at the entrance to the mine complex south of 122, a site that will not be impacted during the proposed project.

Other wildlife inhabitants observed in the mines included deer mice (*Peromyscus maniculatus*) and desert woodrats (*Neotoma lepida*). In some shafts, Say's phoebes (*Sayornis saya*) were nesting inside the entrances. Barn owl nests (*Tyto alba*) were found in shafts 72A and 72L, while individual owls were seen in shafts 99, 116, 140 and 196. It is possible that more owls could have been in the latter four shafts, but upon observing the owls from above, the mines were not entered. In addition, dead animal species found at the bottom of mine shafts included desert spiny lizard (*Sceloporus magister*), desert tortoise (*Gopherus agassizii*), red racer (*Masticophis flagellum*), western shovelnosed snake (*Chionactis occipitalis*), Mojave ground squirrel (*Spermophilus mohavensis*), Antelope ground squirrel (*Ammospermophilus leucurus*), desert woodrat (*Neotoma lepida*), deer mouse (*Peromyscus maniculatus*), black-tailed jackrabbit (*Lepus californicus*) and desert cottontail (*Sylvilagus audubonii*). These are not considered residents of the mines, but victims.

DISCUSSION

As indicated by Table I, the mines of the Rand Project do not harbor a large bat fauna. If a maternity roost was present within a mine, several *Plecotus* would be observed departing at dusk. The only 2 mines with more than a single *Plecotus* observed were 173 and the complex south of 122 on the west side of the project area. Neither of these mines is slated for disturbance under the current CUP (Conditional Use Permit). The single *Plecotus* observed exiting the mines were

probably males, who roost alone during the summer. These bats could potentially hibernate in the mines in the winter, but surveying for inactive bats in some of the shafts would be impossible. In addition, bats should not be disturbed or removed during the winter, which is when the project is to commence. Therefore, in early fall, those shafts that will be impacted by the project will be covered with wire mesh after the evening exodus to prevent bats from reentering. Two of the shafts (#122 south and 173) that had *Plecotus* exiting and one adit in which *Plecotus* guano was seen (#126) will not be impacted by the proposed project, and could provide a roost for any displaced bats. Additional abandoned mines exist offsite, although they have not been surveyed for their suitability as bat habitat. Different bat species have different roost requirements, and only a fraction of mines provide the right environmental conditions.

Several other bat species of concern could occur within the project area. These include the western mastiff bat (*Eumops perotis*) and the spotted bat (*Euderma maculatum*), both USFWS Category 2 Candidate species. Mastiff bats roost in crevices in cliffs and boulders, and emit an audible low frequency echolocation call. Spotted bats utilize crevices in cliff faces when roosting and also emit a distinctive echolocation signal. Neither of these species was detected during this survey. The possibility exists that they could colonize the high walls of the open pit mine after the operations cease.

IMPACTS AND MITIGATION

The proposed project will eliminate bat foraging and roosting habitat. Any rock-crevice roosting bats, such as *Pipistrellus*, *Myotis* and *Antrozous*, could be killed, since these bats are impossible to detect or remove from crevices. The numbers of *Plecotus* living in the historic workings is relatively low. Care should be taken to exclude them from the mines prior to project activities. Three mines that had bats roosting in them will be left open. To protect humans and bats, these shafts should to be fenced. During operations, the mines are provided security, but fencing should be installed as part of the reclamation program. Depending upon the proximity of these shafts to blasting and other mine activities, the bats may not roost there during the project.

TABLE I

BATS IN THE MINES OF THE RAND PROJECT

Shaft #	Species	# Exit	# Enter	Net
72F	<i>Plecotus</i>	2	1	1
72K	<i>Plecotus</i>	1	0	1
	<i>Myotis</i>	2	1	1
17D	<i>Plecotus</i>	1	1	0
	<i>Myotis</i>	3	1	2
102J	<i>Plecotus</i>	1	0	1
	<i>Myotis</i>	1	1	0
122south	<i>Plecotus</i>	4	3	1
	<i>Myotis</i>	20?	10?	10?
173	<i>Plecotus</i>	8	0	8
	<i>Myotis</i>	2	2	0
72A	<i>Myotis</i>	1	0	1

Surveyed for
Randall Project
April - Aug 1993

Survey for
Baltic Project
Aug - Sept 1992

JOHANNESBURG
CALIFOR
7.5 MINUTE SERIES

SW 1/4 RANDSBURG 15

LONE PINE 92 MI.
INYO KERN 24 MI.

395

R



Survey Area
West Dump site



APPENDIX J

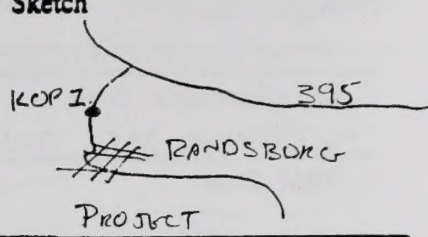
Visual Contrast Rating Sheets

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date 07-15-93
District CALIFORNIA DESERT
Resource Area REDGE CREST
Activity (program) 3809

SECTION A. PROJECT INFORMATION

1. Project Name <u>RAND PROJECT</u>	4. Location Township <u>29S</u> Range <u>40E</u> Section <u>35</u>	5. Location Sketch 
2. Key Observation Point <u>RANDBURG ACCESS ROAD</u>		
3. VRM Class <u>III</u>		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	FOREGROUND: SMOOTH, BOUNDED BACKGROUND: ROLLED, MODERATE, MINOR GEOMETRIC	COARSE, SHORT	LINEAR, GEOMETRIC
LINE	FOREGROUND: WAVE, UNDOULATED BACKGROUND: BOLD, ANGULAR CONVEX	DIFFUSE SOFT	ANGULAR, HORIZONTAL
COLOR	FOREGROUND: ~~GREEN~~ , GRAY, TAN BACKGROUND: BROWN TO RED TO TAN	GREEN, TAN, OLIVE BROWN	BROWN, WHITE, GRAY
TEXTURE	SMOOTH, DISCONTINUOUS	MEDIUM, EVEN RANDOM	PATCHY, DIRECTIONAL

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	SOLID, GEOMETRIC, SMOOTH	-	-
LINE	ANGULAR, CONVEX	-	-
COLOR	BROWN, RED, TAN	-	-
TEXTURE	SMOOTH CONTRASTY	-	-

SECTION D. CONTRAST RATING ☒ SHORT TERM ☒ LONG TERM

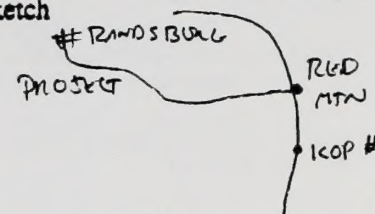
1. DEGREE OF CONTRAST	FEATURES												2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)	3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)		
	LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)							
	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None				
Form		✓					✓								Evaluator's Names <u>RECHARD F. DETONL</u>	Date <u>7-15-93</u>
Line			✓				✓									
Color			✓				✓									
Texture			✓				✓									

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date 7-15-93
District CALIFORNIA DESERT
Resource Area REDGE CRUST
Activity (program) 3809

SECTION A. PROJECT INFORMATION

1. Project Name <u>RAND PROJECT</u>	4. Location Township <u>30S</u> Range <u>41E</u> Section <u>7</u>	5. Location Sketch 
2. Key Observation Point <u>US HIGHWAY 395, SOUTH OF RED MTN.</u>		
3. VRM Class <u>III</u>		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	FOREGROUND: FLAT BACKGROUND: ROLLING, MINOR GEOMETRIC	CONUSSE, SHORT	LINEAR, GEOMETRIC
LINE	FOREGROUND: FLOWING BACKGROUND: CONVEX, MINOR ANGULAR	SOFT	ANGULAR, HORIZONTAL
COLOR	<u>TAN</u>	<u>TAN, OLIVE</u>	<u>GRAY, BROWN, WHITE</u>
TEXTURE	<u>SMOOTH</u>	<u>MEDIUM, EVEN RANDOM</u>	<u>DIRECTIONAL</u>

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	<u>LINEAR, WEAK</u>	<u>-</u>	<u>-</u>
LINE	<u>HORIZONTAL</u>	<u>-</u>	<u>-</u>
COLOR	<u>TAN, GRAY</u>	<u>-</u>	<u>-</u>
TEXTURE	<u>SMOOTH, DIRECTIONAL</u>	<u>-</u>	<u>-</u>

SECTION D. CONTRAST RATING ☒ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST	FEATURES												2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)	3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)	
	LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)						
	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None			
FORM			☒				☒								Evaluator's Names <u>RICHARD F. DELONG</u>
LINE			☒				☒								
COLOR			☒				☒								
TEXTURE			☒				☒								

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

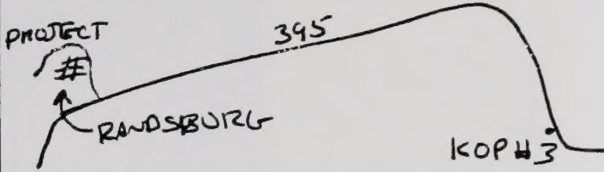
Date 08-05-94

District CALIFORNIA DESERT

Resource Area RIDGECREST

Activity (program) 3809

SECTION A. PROJECT INFORMATION

1. Project Name <u>RAND PROJECT</u>	4. Location Township <u>29S</u> Range <u>40E</u> Section <u>35</u>	5. Location Sketch 
2. Key Observation Point <u>HIGHWAY 395, NORTH FREMONT VALLEY</u>		
3. VRM Class <u>III</u>		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	FOREGROUND: SMOOTH, ROUNDED BACKGROUND: STEEP, DENSE, PYRAMIDAL MINOR GEOMETRIC	COARSE, SITUAT	LEAN, GEOMETRIC
LINE	FOREGROUND: WIDE, MODERATE BACKGROUND: BOLD, ANGULAR, CURVED	DIFFUSE, SOFT	ANGULAR, HORIZONTAL
COLOR	BROWN, TAN	GREEN, TAN, OLIVE, BROWN	BROWN, TAN, GRAY
TEXTURE	SMOOTH, DISCONTINUOUS	MEDIUM, EVEN, RANDOM	PATCHY, DIRECTIONAL

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	SOLID, GEOMETRIC, SMOOTH	-	-
LINE	ANGULAR, CURVED	-	-
COLOR	GRAY, BROWN, TAN	-	-
TEXTURE	SMOOTH, CONTRAST	-	-

SECTION D. CONTRAST RATING ☒ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST	FEATURES												2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)	3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)			
	LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)								
	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None					
Form		✓					✓										
Line			✓				✓										
Color			✓				✓										
Texture			✓				✓										

Evaluator's Names

RICHARD F. DELONG

Date

8-5-94





Photograph J-1: From KOP #1, Looking South. View of the Current Operations.



Photograph J-2: From KOP #1, Looking South. View of the Approved Operations After Completion of Reclamation.





Photograph J-3: From KOP #1, Looking South. View of the Proposed Action After Completion of Reclamation.



Photograph J-4: Aerial Photograph, Looking Southwest. View of the Current Operations.





Photograph J-5: Aerial Photograph, Looking Southwest. View of the Approved Operations After Completion of Reclamation.





Photograph J-6: Aerial Photograph, Looking Southwest. View of the Proposed Action After Completion of Reclamation.



APPENDIX K

Acoustical Analysis Report for Rand Mining Company Baltic Mine
Randsburg, Kern County, California



WALKER, CELANO & ASSOCIATES

Consultants on Acoustics

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805/497-1902

FAX 805/495-9933

ACOUSTICAL ANALYSIS REPORT

FOR

RAND MINING COMPANY BALTIC MINE

RANDBURG, KERN COUNTY, CALIFORNIA

June 8, 1993

Prepared for:

Rand Mining Company
P.O. Box B
Randsburg, CA 93554



INTRODUCTION

The Conditional Use Permit (CUP) for the Baltic Mine project requires that an acoustical analysis of the operation be performed to demonstrate compliance with the requirements of the Noise element of the Kern County General Plan. This report presents the results of a noise monitoring program conducted in the vicinity of the Baltic Mine and analysis of potential noise impacts on nearby residential uses.

CRITERIA

The Noise Element of the Kern County General Plan has adopted Day Night Noise Level (DNL) 65 dB and 45 dB (A-weighted) as the maximum allowable noise exposure at outdoor and indoor living areas, respectively, of residential developments. The Noise Element does not contain specific criteria for noise due to mining operations or for noise due to blasting.

National Research Council (NRC) documents, *Guidelines for Preparing Environmental Statements on Noise* (1977) and *Assessment of Community Response to High-Energy Impulsive Sounds* (1981), recommend use of C-weighted DNL when evaluating impulsive noise sources such as blasting. Specifically, NRC recommends computing the C-weighted DNL for environments subjected to impulses having a C-weighted level of 75 dB or greater. The C-weighted DNL due to the blast noise is then added logarithmically to the A-weighted noise exposure due to other noise sources and the composite is utilized to evaluate the overall noise environment.

The recommendation for use of C-weighting for blast noise analysis was confirmed by additional research conducted by Schomer at the U.S. Army, Construction Engineering Laboratory (CERL) that was published in 1985 and 1986.



The Walsh-Healy hearing conservation regulations state that exposure to any single impulse noise should not exceed 140 dB, peak sound pressure level.

NOISE MONITORING

Mine related noise in the vicinity of the Baltic Pit operation results from two sources. The first is general mining activity including front end loaders, off-road dump trucks, bulldozers, rock drills, etc., which operate essentially 24 hours a day, 7 days a week, except for specific holidays. The second is blasting, which typically occurs once a day during weekdays only.

General Operational Noise:

Monitoring was conducted at three locations adjacent to residential areas near the Baltic Pit on three occasions. The first series of measurements encompassed essentially an entire day starting approximately 12:50 p.m. on February 16, 1994 and ending approximately 10:20 a.m. on February 17 when rain halted the measurements. The second set of measurements occurred on March 16, 1994 in the early afternoon. The third series of measurements encompassed most of a day starting approximately 4:00 p.m. on May 24, 1994 and ending approximately 10:20 a.m. on May 25. The measurement locations are described below and will be referred to by number in the remainder of this report.

- G 1. The southerly end of the abandoned portion of Butte Avenue at the intersection with Osdick Road. This is the entry point to the "Dog Patch" residential area.
- G 2. The northerly end of the abandoned portion of Butte Avenue adjacent to the Rand Mining fence line. This location was the northerly end of Dog Patch.
- G 3. Adjacent to the driveway to 35657 Butte Avenue. Only one measurement was attempted at this location due to an extremely noisy and persistent dog that barked through all but approximately 3 minutes of the 15 minute measurement sample.

During the February 16-17 measurements, activity on the southerly portion of the Baltic pit closest to the Dog Patch residential area consisted primarily of drilling related operations. During the March 16 measurements, there was minimal nearby mining activity. During the May 24-25 measurements, activity on the southerly



portion of the Baltic pit closest to the Dog Patch residential area consisted of ore loading and drilling related operations.

The measurements were taken with a Rion type NA-29E precision integrating sound level meter octave band real time analyzer connected to a PC compatible portable computer. The measurement microphone was supported on a stand and was fitted with Bruel & Kjaer (B&K) type UA 0237 foam windscreen. Typically, each of the measurement periods was 15 minutes total duration and consisted of a series of 900 consecutive 1 second time average (L_{eq1sec}) samples. The analyzer simultaneously measured the overall A-weighted level and the A-weighted level in each of the octave bands over the range of 31 Hz to 8000 Hz. At the end of the 15 minute period, the analyzer calculated the statistical levels for the measurement period and all of the measured and calculated data were transferred to the computer for storage on magnetic disk. Prior to, and periodically throughout the measurements, the overall calibration of the system was checked with a B&K type 4231 acoustic calibrator (certification June 93). The results of the measurements are summarized in Tables 1 and 2, below. Copies of the computer printouts showing the time lines and statistical distribution of the overall A-weighted noise levels and the frequency spectra of the intrusive (L_1), ambient ($L_{eq15min}$) and background (L_{90}) noise levels are contained in Appendix B.

It should be noted that although the data in this study are presented to an apparent precision of 0.1 dB, which is the resolution of the digital displays on the analyzers, this is for purposes of comparison and illustration only. The absolute calibration accuracy of the measurement system is approximately 0.5 dB. Generally, sound level differences of approximately 1 dB are just perceptible to an average listener, differences of 3 dB are clearly perceptible and differences of 10 dB are considered to be half or twice as loud. Similarly, the 0.1 dB precision shown for computed values was retained to minimize the cumulative effects of round off errors.

The individual measured daytime and nighttime average noise levels for each 15 minute sample period and measurement location were averaged for each day, and the DNL was estimated for each of the positions. These results are also shown in Tables 1 and 2.



Pos	Date	Start Time	A-weighted Noise Level - dB				Non Mine Noise Sources
			Intrusive L_1	Ambient L_{eq}	Background L_{90}	Est DNL	
G 1	2/16	12:53	50.5	39.0	29.6	54.6 (53.5 w/o non- mine noise)	Planes
		13:15	70.2	56.3	27.5		Planes & Fire Truck
		18:38	44.5	36.7	26.8		Auto Thermal "Tic", Dog
		20:20	40.9	35.3	31.4		Auto Thermal "Tic"
	2/17	03:44	52.2	47.7	44.5		
G 2	2/16	20:45	48.7	42.2	38.7	53.4	
		22:37	51.9	47.4	43.2		
		22:55	47.7	41.6	38.9		
		23:13	47.4	41.8	39.2		
		23:31	49.2	44.2	40.8		
	2/17	00:03	51.2	47.1	44.0		
		04:36	57.5	51.6	46.5		
		08:12	57.0	48.6	40.4		
		10:28	55.2	47.4	41.8		
	3/16	11:46	54.0	44.8	37.6		Wind
		12:40	57.0	46.4	38.2		Very Windy
		12:59	53.6	44.4	38.6		Wind
G 3	2/16	18:11	60.6	52.9	27.8	< 55	Noisy Dog

Table 1
 Summary of Measured Noise Levels
 February and March 1994 Measurements

Note that at Position G 1, the average sound level during the 13:15 measurement sample on February 16, was set by aircraft overflights and the nearby passage of a fire truck on Osdick Road. If these extraneous noise sources are eliminated from the sample, the average noise level would be similar to the 12:53 sample. This change would reduce the computed DNL at Position G 1 by approximately 1 dB to 53.5 dB, essentially the same as Position G 2.

The monitoring of general mining noise on March 16, was terminated immediately after the blast measurements due to minimal nearby mining activity and high wind which was the dominant noise source during the measurements.



Pos	Date	Start Time	A-weighted Noise Level - dB				Non Mine Noise Sources
			Intrusive L_1	Ambient L_{eq}	Background L_{90}	Est DNL	
G 1	5/24	17:04	32.6	29.1	23.6	53.6 (52.1 w/o non- mine noise)	Auto Thermal "Tic"
		18:40	49.4	40.7	31.3		Wind
		20:07	40.4	34.4 (31.5)	27.5		Insects
		22:17	54.0	49.1 (47.6)	47.0		Insects
	5/25	00:03	53.8	46.9 (42.1)	44.3		Insects, Auto on Osdick
		01:18	53.5	46.7 (44.8)	43.1		Insects
		03:25	52.2	45.3 (44.1)	42.0		Insects
		04:26	56.6	49.2 (48.7)	44.5		Insects, Auto on Osdick
		07:46	53.4	45.1	38.5		Plane, Auto on Osdick
		09:21	55.8	44.9	38.2		Autos on Osdick
G 2	5/24	15:48	48.0	39.6	33.2	52.8	Wind
		17:31	42.4	36.3	32.8		
		19:04	47.5	38.7	33.8		Wind
		19:22	54.0	46.3	38.7		Very Windy
		19:40	50.7	41.6	35.2		Wind
		22:39	56.9	47.6	31.5		
		22:59	38.8	33.4	31.5		
		23:18	52.0	44.9	40.4		
		23:36	48.9	43.4	34.6		
	5/25	01:40	46.2	38.4	33.8		
		01:58	53.8	47.2	42.3		
		02:15	57.1	51.5	47.5		
		02:34	55.2	49.8	46.0		
		03:02	54.8	48.9	44.9		
		04:50	46.6	40.8	36.4		
		05:21	52.1	41.8	37.1		
		05:45	52.7	45.1	40.2		
		06:04	55.1	48.4	43.9		
		06:24	49.0	41.4	36.7		
		07:20	60.2	49.8	41.0		Plane
		09:42	61.2	49.6	41.1		Plane
		10:01	53.9	46.3	39.6		Plane

Table 2
 Summary of Measured Noise Levels
 May 1994 Measurements



Note that evening and nighttime noise levels at Position G 1 on May 24-25 were influenced by insect noise. This can be seen on the appended plots as peaks in the frequency spectra in the 4 kHz octave band. With the insect noise subtracted from the spectrum, the A-weighted ambient ($L_{eq15min}$) noise levels of these samples would be reduced by approximately 1 dB for the 22:17 and 03:25 samples, 2 dB for the 01:18 sample, 3 dB for the 20:07 sample, and almost 5 dB for the 00:03 sample. The computed values with the insect noise removed are shown in parentheses in Table 2. In addition, several of the samples at Position G 1 contained automobile and aircraft noise. If all these extraneous noise sources are eliminated from the data, the estimated DNL at Position G 1 would be reduced by approximately 1.5 dB to 52.1 dB, slightly lower than Position G 2.

Upon examination of the data in Tables 1 and 2, it can be seen that outdoor noise exposure in the vicinity of existing residential area, due to the observed general mining operation noise and miscellaneous extraneous noise sources such as aircraft overflights, nearby automobile and truck traffic and noisy insects, is below DNL 55 dB. Noise exposure due to general mine-related non-blast noise sources is in the DNL 52-54 dB range.

Blasting Noise:

Noise due to blasting operations was monitored simultaneously at multiple microphone locations on three occasions. The first blast which occurred on February 16, 1994 was reported by the applicant to be especially loud, due to unusual conditions at the blast site, and not typical of "normal" blast events. Therefore, it was requested that additional blasts be monitored. The second blast measurement occurred on March 16, 1994 and was reported by the applicant to be a "normal" blast. The third blast measurement occurred on May 24, 1994 and was also reported by the applicant to be a "normal" blast.

The first blast was located at the southerly end of the Baltic mine area. It consisted of 200 individual charges distributed over an area of approximately 2 acres that were detonated in a predefined sequence, generally from north to south towards the measurement positions. The first measurement position (B 1) was located approximately 245 ft southerly of the Rand Mining fence line, approximately 150 ft westerly of Butte, and was approximately 1750 ft from the center of the blast site. The second position (B 2) was approximately 275 ft southerly of the fence line, approximately 1300 ft westerly of Baltic, and was



The second blast was located near the middle of the Baltic mine area. It consisted of 230 individual charges distributed over an area of approximately 2 acres that were detonated in a predefined sequence, generally from south to north away from the measurement positions. The first measurement position (B 1 from the first day) was approximately 2500 ft from the center of the blast site. The other positions B 3 and B 4 were approximately 1900 ft from the center of the blast site.

The third blast was located on the westerly side of the Baltic mine area. It consisted of 143 individual charges distributed over an area of approximately 1.2 acres that were detonated in a predefined sequence, generally from south to north away from the measurement positions. The first measurement position (B 1 from the first day) was approximately 2600 ft from the center of the blast site. The other positions B 5 and B 6 were approximately 1600 ft from the center of the blast site.

Measurements at position B 1 utilized the Rion NA-29 analyzer described above and a Panasonic SV-255 digital audio tape recorder. Measurements at positions B 2 through B 6 utilized Bruel & Kjaer (B&K) type 4165 condenser microphones, B&K type 2639 preamplifiers, B&K type 2804 power supply, an EAD SC-2 signal conditioning amplifier and a Panasonic type SV-3500 digital audio tape recorder.

The data on the digital tape recordings was processed in the laboratory to determine sound exposure level (SEL) and maximum sound pressure values. The SEL was determined utilizing flat, A and C weighting. The results are summarized in Table 3, below and copies of computer printouts showing representative frequency spectra of the SEL and the time history of the peak noise peak sound pressure are contained in the appendix. The measured SEL and peak SPL values were normalized using a simple spherical-wave spreading model to a 1000 ft reference distance for use in the subsequent analyses. These normalized values are shown in the right most columns of Table 3.



Date	Pos	Approx Distance from Blast feet	Measurement Results					Computed Values at 1000 ft Reference Distance			
			SEL - dB			Maximum Blast Noise		SEL - dB			Maximum Blast SPL - dB
			A-wtd	C-wtd	Flat	Sound Pres - Pascals	SPL - dB	A-wtd	C-wtd	Flat	
2/16	B 1	1100	95.3	119.3	124.5	200	140.0	96.1	120.1	125.3	140.8
	B 2	1750	95.4	115.5	120.4			100.3	120.4	125.3	
3/16	B 1	2500	66.4	90.3	99.4	5.1	108.0	74.4	98.3	107.4	116.0
	B 3	1900		93.7					99.3		
	B 4	1900		94.0					99.6		
5/24	B 1	2200		<89.5	95.7	2	99.8		<96.3	102.5	106.6
	B 5	1500	55.4	89.6	106.1	4.9	107.7	58.9	93.1	109.6	111.2
	B 6	1500	55.4	89.4				58.9	92.9		

Table 3
Summary of Blast Noise Data

The mine operator reported that noise levels comparable to those produced by the February 16 blast are unusual, possibly one occurrence out of five to ten blasts. If it is assumed that one blast out of five is comparable to the February 14 event and four of five are comparable to the March 16 and May 24 events, the average C-weighted sound exposure level would be approximately SEL 114 dB at the 1000 ft reference distance. If the February 14 event is assumed to be a one in ten occurrence and the March 16 and May 24 events are typical of nine of ten blasts, the average C-weighted sound exposure level would be approximately SEL 111 dB at 1000 ft.

The three blasts that were monitored for this report occurred in the southerly and central portions of the Baltic Mine area. The entire Baltic area extends approximately 2500 ft from north to south. Table 4, below, shows computed noise exposure in the Dog Patch residential area for blasts occurring in various portions of the Baltic mine assuming the "maximum" SEL value of 120 dB from the loudest of the three measured blasts, "average" SEL values of 114 dB and 111 dB as described above, and a "minimum" SEL value of 96 dB, the result from the quietest of the three measured blasts.



Blast Location	Approx Distance from Dog Patch - feet	Estimated C-wtd DNL - dB in Dog Patch for Various Blast Sound Exposure Levels (SEL at 1000 ft)			
		SEL _{max} 120 dB	SEL _{avg} 114 dB	SEL _{avg} 111 dB	SEL _{min} 96 dB
Southerly	2000	64.6	58.6	55.6	40.6
Center	3000	61.1	55.1	52.1	37.1
Northerly	4000	58.6	52.6	49.6	34.6

Table 4
 Range of Blast Noise Exposures in
 Dog Patch for Various Blast Noise Levels and Locations

Upon examination of Table 4 it can be seen that the C-weighted blast noise exposure in Dog Patch could range from a high of just less than DNL 65 dB for a "worst" case blast like the one measured on February 16 located in the extreme southerly portion of the pit to less than DNL 35 dB for a "quiet" blast located in the northerly portion of the mine. For comparison, the DNL computed from the A-weighted data would be more than 20 dB lower, i.e. below 45 dB for the worst case blast.

The peak SPL due to the February 16 blast was approximately 140 dB at a distance of approximately 1100 ft from the center of the blast area. This would correspond to a peak level of approximately 135 dB at a distance of 2000 ft in the residential area. The literature reports that peak levels due to individual short duration impulsive sources at levels below 140 dB are not likely to cause adverse health effects or damage to structures. The peak blast noise due to the March 16 blast was approximately 108 dB at a distance of approximately 2500 ft. This would correspond to approximately 110 dB at the 2000 ft distance between a blast occurring at the southerly end of the mine and the Dog Patch residential area. Peak blast noise due to the May 24 blast was somewhat lower, approximately 108 dB at approximately 1500 ft. This would correspond to approximately 106 dB at the 2000 ft distance between a blast occurring at the southerly end of the mine and the Dog Patch residential area.

Composite Noise Exposure:

On the basis of the measurement data, A-weighted mine-related non-blast noise exposure in the Dog Patch residential area would be below DNL 54 dB and C-weighted blast noise exposure would be DNL 64.6 dB or lower. Therefore, the composite noise exposure, computed per NRC recommendations, would be



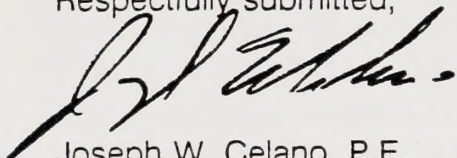
DNL 65 dB or lower, on a day that a blast occurs, depending on the actual location and strength of the blast. This would conform with the County's DNL 65 dB outdoor noise requirement. On days when there is no blasting, the overall mine-related noise exposure would be below DNL 54 dB as described above.

It was reported by the applicant that blasting typically occurs three to five times a week at the Baltic Pit. Therefore, if the overall noise exposure in the Dog Patch residential area were to be computed on a weekly basis, assuming five "worst case" blasts a week, there would be five days with DNL 65 dB or lower and two days with DNL 54 dB or lower. The composite of these would be a weekly noise exposure of DNL 63.7 dB, or lower. If there were three "worst case" blasts during a given week, the weekly noise exposure would be DNL 61.8 dB, or lower. Alternatively, if the weekly composite noise exposure is calculated based on the 114 dB SEL "average" blast, the results would be DNL 57.7 dB or lower for 5 blasts per week, and DNL 56.6 dB or lower for 3 blasts per week.

DISCUSSION

On the basis of the measurements and analyses described above, the project is in conformance with the County's DNL 65 dB maximum outdoor noise exposure requirement when the noise exposure is computed as recommended by NRC utilizing C-weighted blast noise. The overall noise exposure in the community computed utilizing A-weighted values only, since the County has no specific requirement for blast noise evaluation, would be below DNL 55 dB. It should also be noted that as mining operations progress and the "pit" is formed, noise from mining activity in the bottom of the pit will be somewhat shielded by the walls of the pit. This shielding would tend to reduce noise exposures in Dog Patch.

Respectfully submitted,



Joseph W. Celano, P.E.
Walker, Celano & Associates



APPENDIX A

ACOUSTICAL TERMINOLOGY DEFINITIONS



The following is not intended as a comprehensive glossary of acoustic terminology, however it will provide sufficient information to allow a better understanding of the technical language contained in this document.

- Decibel (dB) - A unit division on a logarithmic scale whose base is the tenth root of ten, used to represent ratios of quantities proportional to power. [In simple terms, if the power is multiplied by a factor of ten, then ten is added to the representation of the power on the decibel scale. If 0 dB represents 1 unit of power, 60 dB represents one million units, etc.]
- Sound Pressure Level (SPL - dB) - The ratio, in decibels, of the mean squared sound pressure to the square of the reference pressure, 20 micropascals.
- A-weighted Sound Level (SLA - dB) - Sound pressure level measured using the A-weighting network, a filter which discriminates against low and very high frequencies in a manner similar to the human hearing mechanism at moderate sound levels (ref. ANSI S1.4).
- Time Average Sound Level (L_{eqT} - dB) - The level, in decibels, of the mean squared sound pressure averaged over time period T. This is often referred to as the "equivalent sound level" and hence the "eq" subscript. The equivalence is to a sound of constant level which has the same total acoustic energy content.
- Community Noise Equivalent Level (CNEL - dB) - The long term average sound level, weighted as follows:
 - a. Frequency response is filtered using the A-weighting network.
 - b. Sounds occurring during the evening hours between 7 p.m. and 10 p.m. are weighted by 5 dB (equivalently, the number of noise events is multiplied by 3.15)
 - c. Sounds occurring during the nighttime hours between 10 p.m. and 7 a.m. are weighted by 10 dB (equivalently, the number of noise events is multiplied by 10).



- Day-Night Average Noise Level (DNL or L_{dn} - dB) - The long term average sound level, weighted as follows:
 - a. Frequency response is filtered using the A-weighting network.
 - b. Sounds occurring during the nighttime hours between 10 p.m. and 7 a.m. are weighted by 10 dB (equivalently, the number of noise events is multiplied by 10).
- Percentile Exceeded Sound Level (L_{PE} - dB) - The sound level (usually A-weighted) which is exceeded PE percent of a specified time period.
- Sound Exposure Level (SEL - dB) - The logarithmic product of the average noise level (usually A-weighted) and the time duration. (It is not an actual measured noise level, but rather it is used in the computation of long term averages such as CNEL and DNL.)
- Octave Band Sound Pressure Level (dB) - The sound pressure level measured using a band-pass filter whose upper cutoff frequency is two times the lower cutoff frequency, and which is identified by the nominal geometric center frequency of the pass band.
- One-Third Octave Band Sound Pressure Level (dB) - The sound pressure level measured using a band-pass filter whose upper cutoff frequency is the cube root of two times the lower cutoff frequency, and which is identified by the nominal geometric center frequency of the pass band.
- Sound Spectrum - The representation of an acoustic signal in terms of its level versus frequency. The most common method for determining the sound spectrum is with an analyzer consisting of a series or bank of contiguous octave or 1/3 octave band filters and a bar-graph or numerical tabular display, known as a real-time analyzer
- Ambient Noise - The noise which results from the combination of all sources, near and far. The ambient noise level is expressed as L_{eqT} , DNL or CNEL as judged appropriate to the situation.
- Background Noise - The steady noise level which characterizes a given environment in the absence of transient sources. The background noise is usually expressed as L_{90} , the noise level which is exceeded 90% of the specified time period.



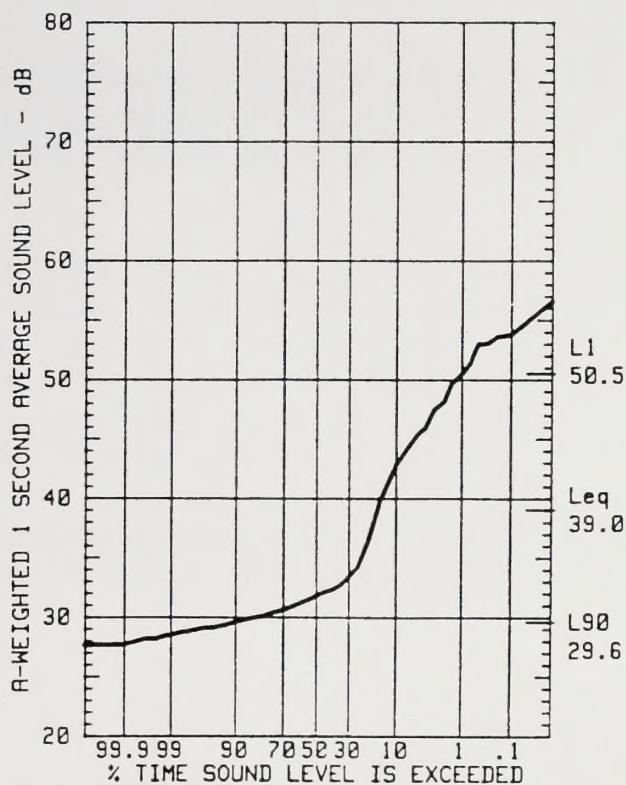
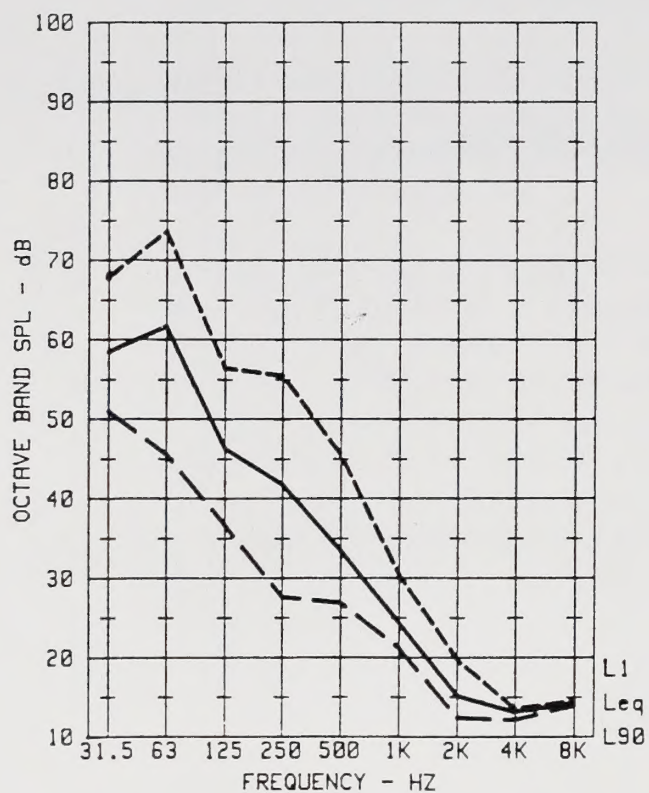
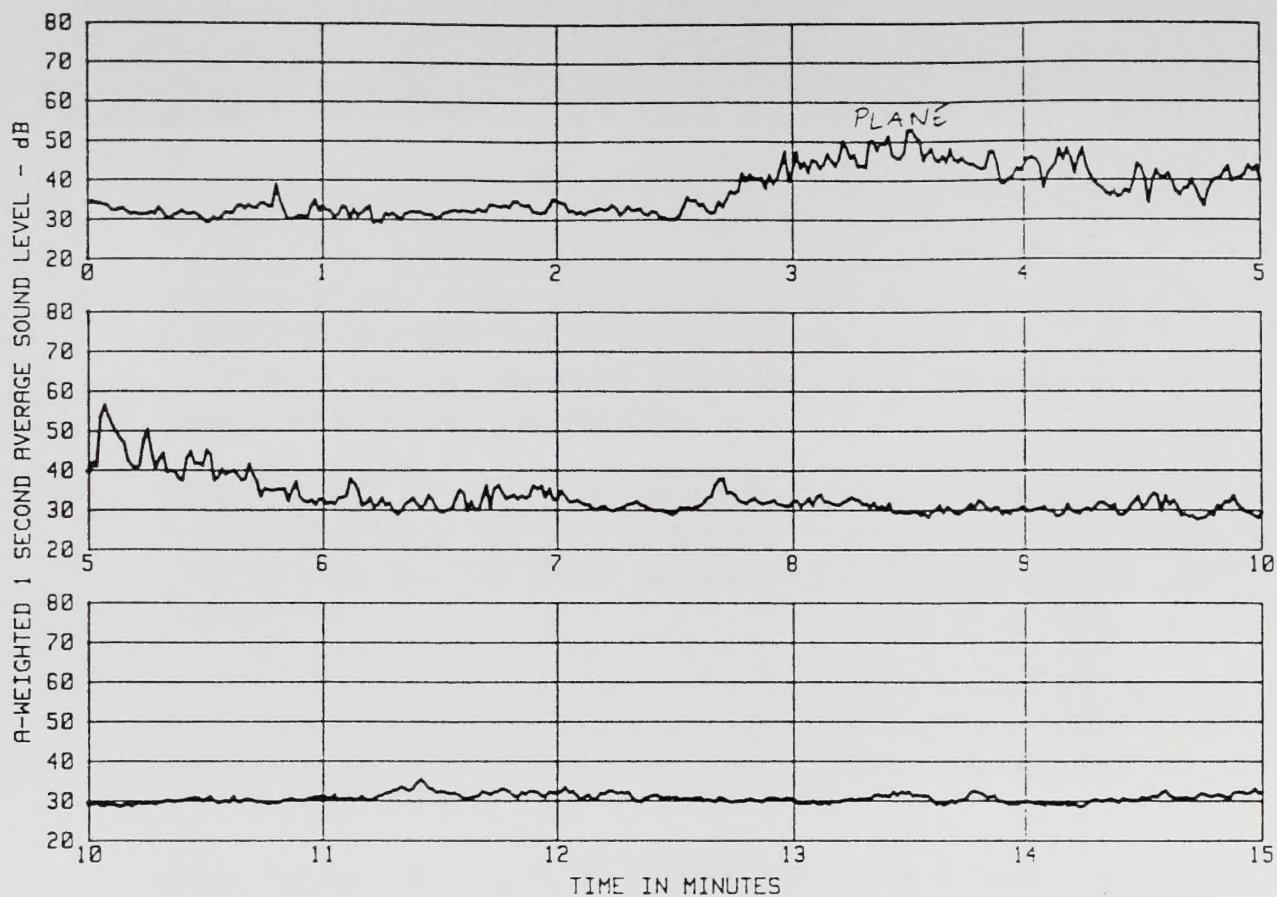
- Intrusive Noise - Noise from an identifiable source which causes a discernable change in the existing acoustic environment. Noises can be intrusive by virtue of excessive overall level, or as the result of unusual spectral or temporal characteristics.
- Noise Contour - A line on a map which indicates locations of constant ambient sound level near or around known sources of noise. In practice, noise contours are often shown as calculated for the dominant sources of noise only.
- Noise Reduction (NR) - The difference in decibels, in a specified frequency band, between the average sound pressure levels in two enclosed spaces connected by one or more sound transmission paths due to a sound source in one of the spaces (ref. ASTM E336).
- Noise Isolation Class (NIC) - A single number rating of the sound isolation between two acoustically connected spaces derived from the measured noise reduction (ref. ASTM E336).
- Sound Transmission Loss (TL) - The difference in decibels, in a specified frequency band, between the sound power incident on the "partition" and the sound power transmitted by the partition and radiated on the receiving side (ref. ASTM E90).
- Sound Transmission Class (STC) - A single number rating of the sound isolating capability of a building construction element with respect to speech, radio, television, and similar sources of noise in offices and dwellings. The rating is derived from the measurement of the sound transmission loss of the element over a series of 16 contiguous 1/3 octave bands centered from 125 Hz to 4000 Hz. The application of the STC rating to the isolation of sounds due to exterior noise sources such as motor vehicles or aircraft and sounds due to machinery, industrial noise sources, transformers, etc., is specifically excluded by the defining standard (ref. ASTM E413).



APPENDIX B
ACOUSTIC MEASUREMENT DATA
AND
COMPUTER PRINTOUT SHEETS

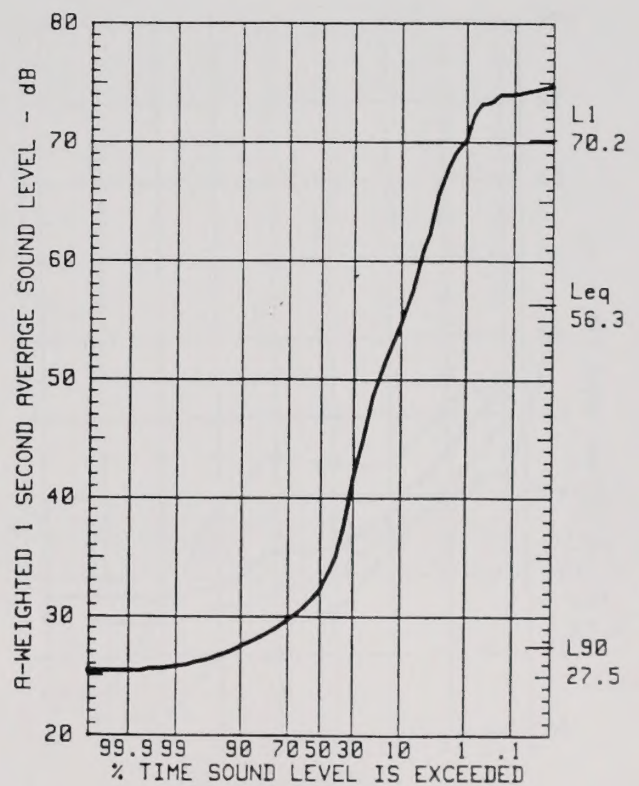
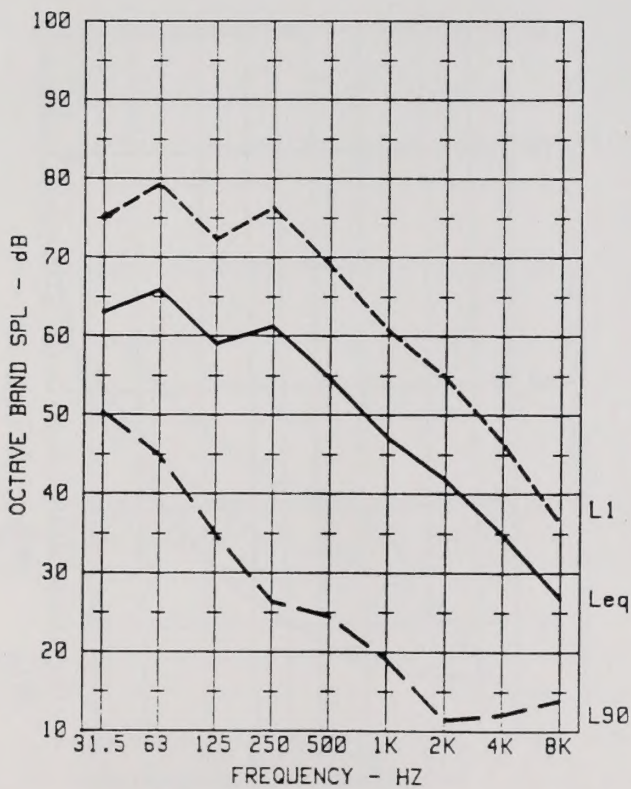
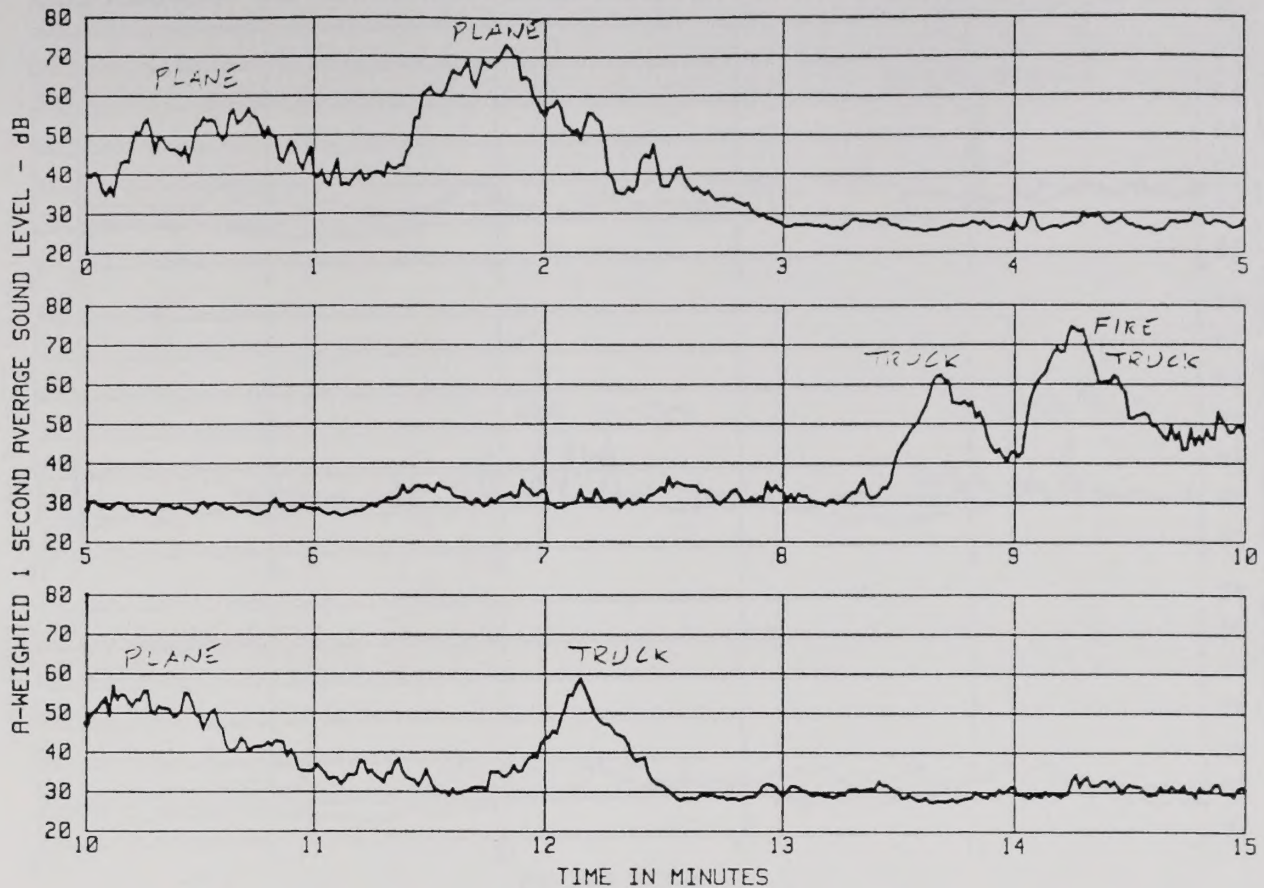


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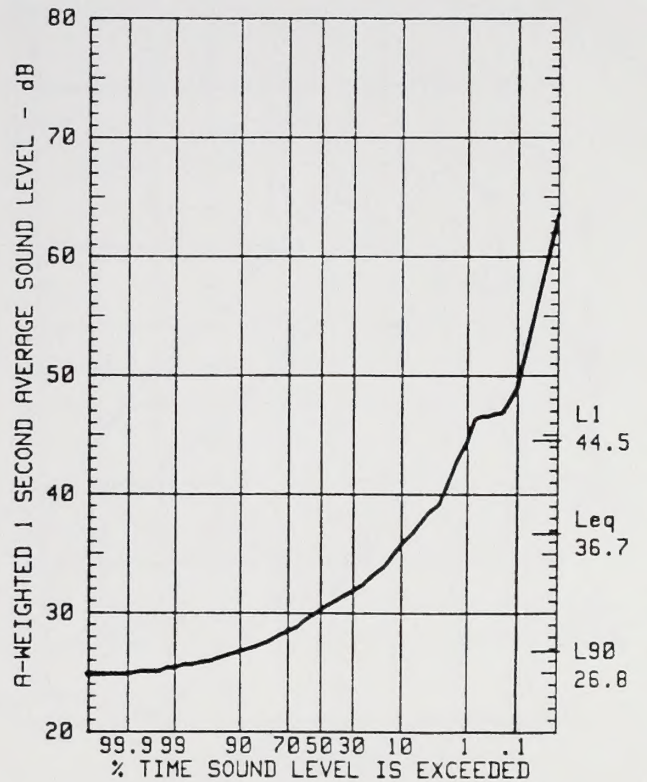
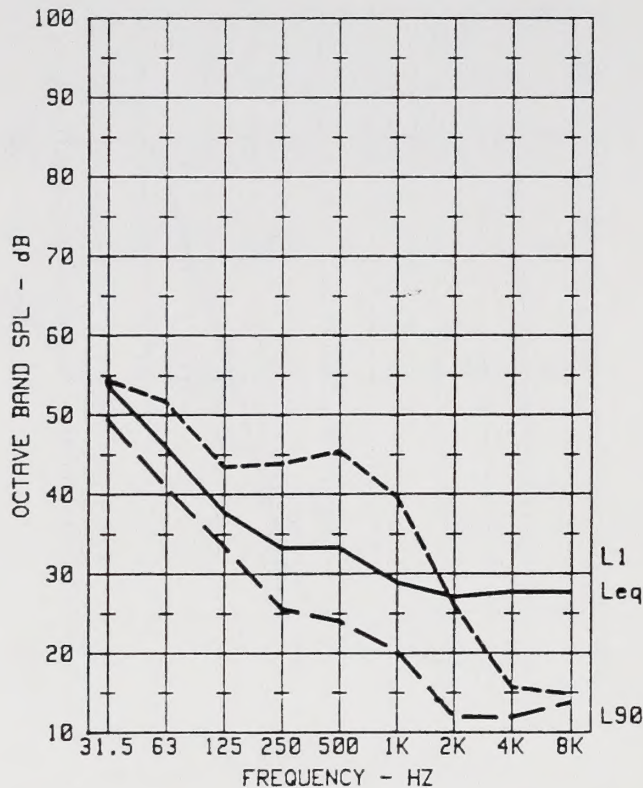
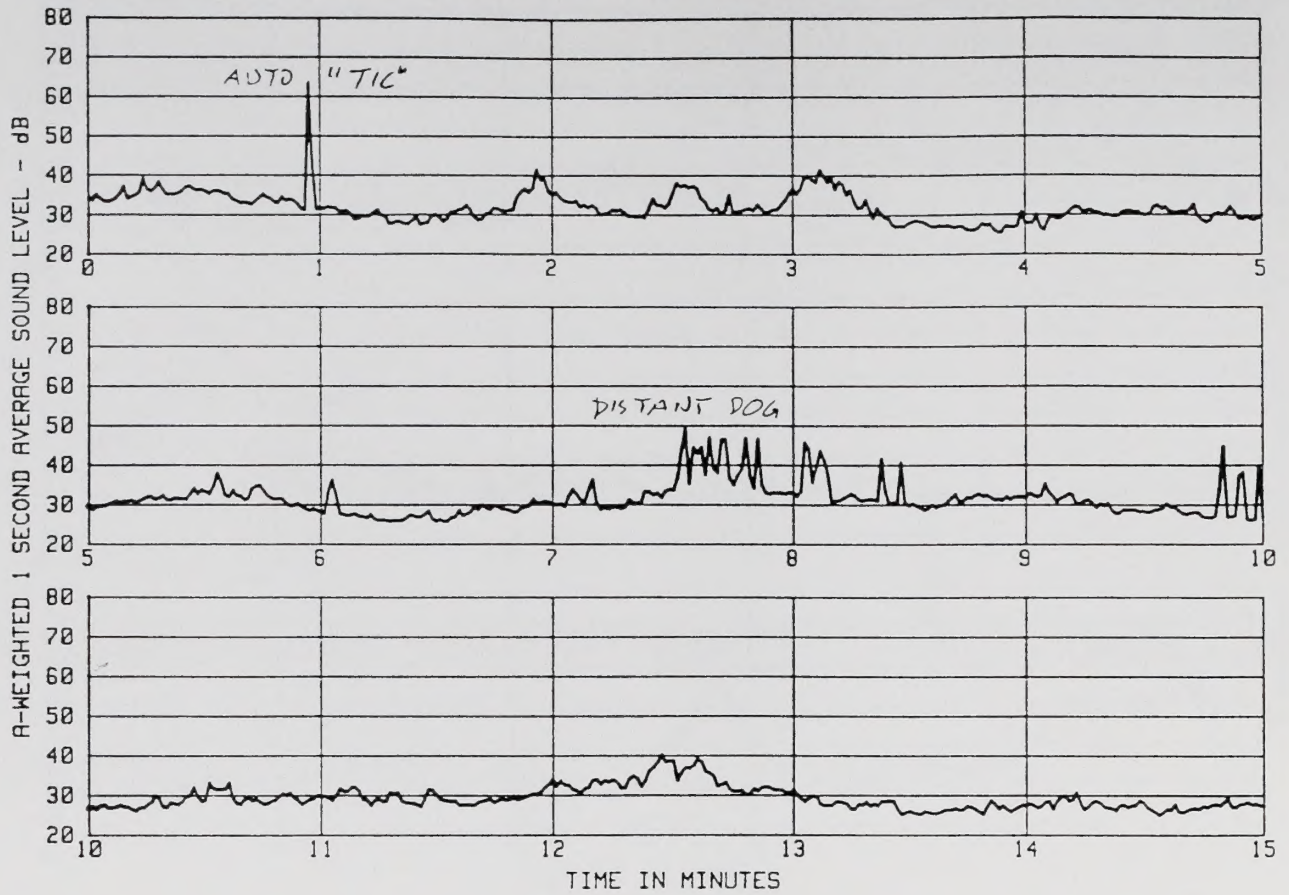
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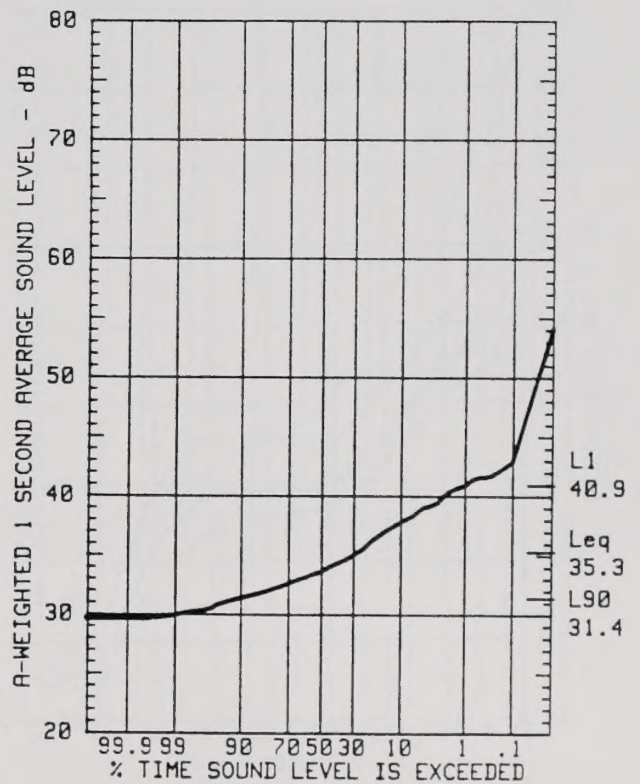
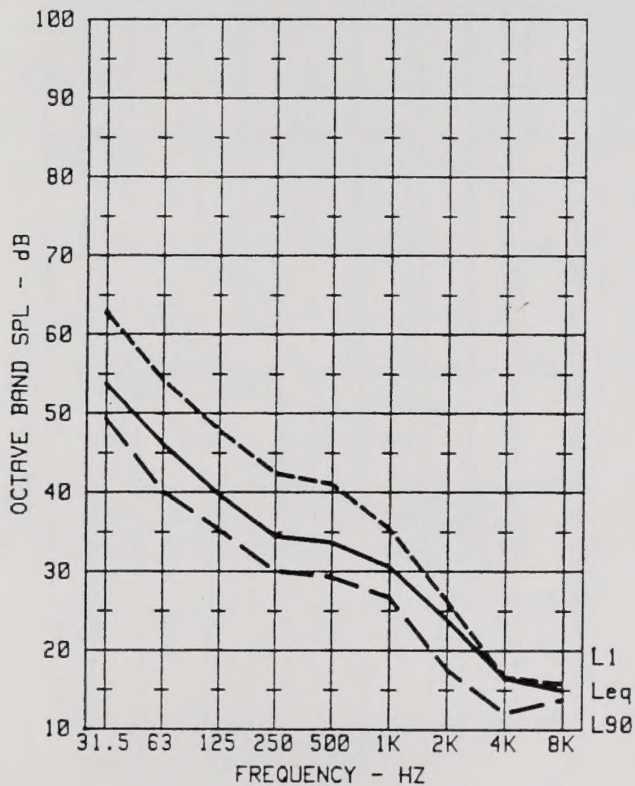
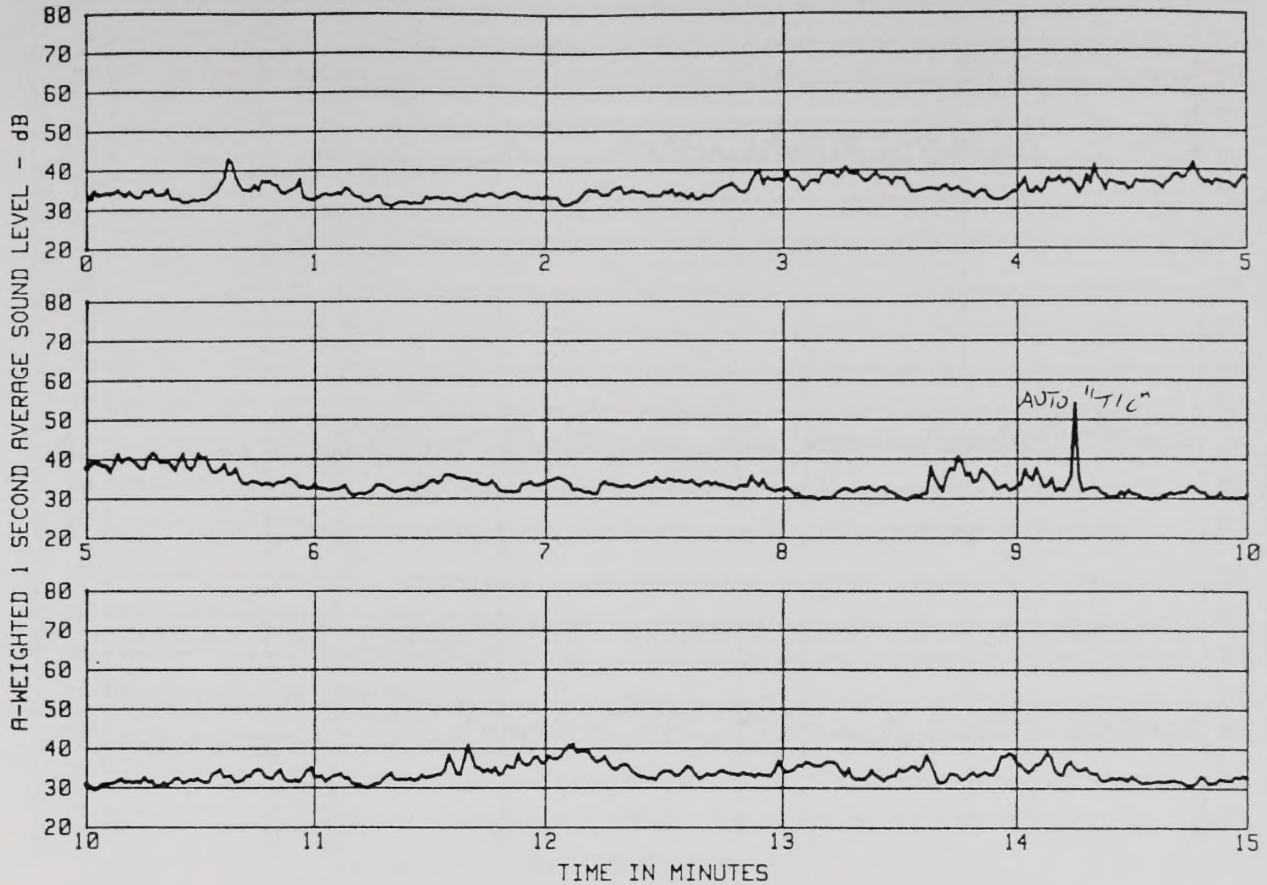
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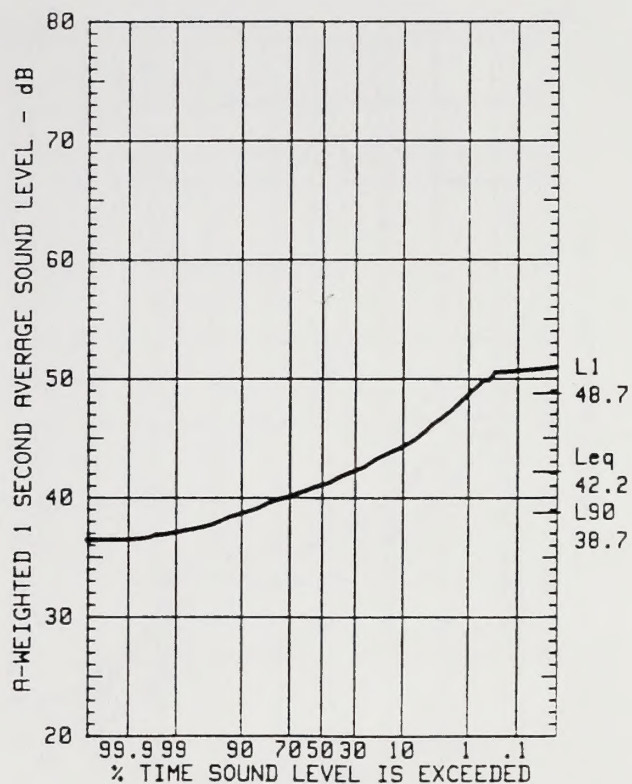
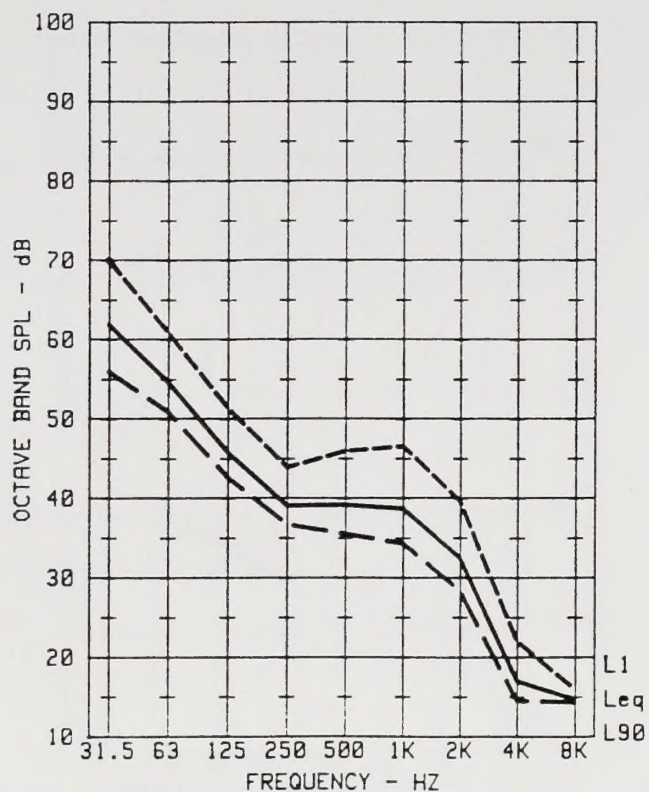
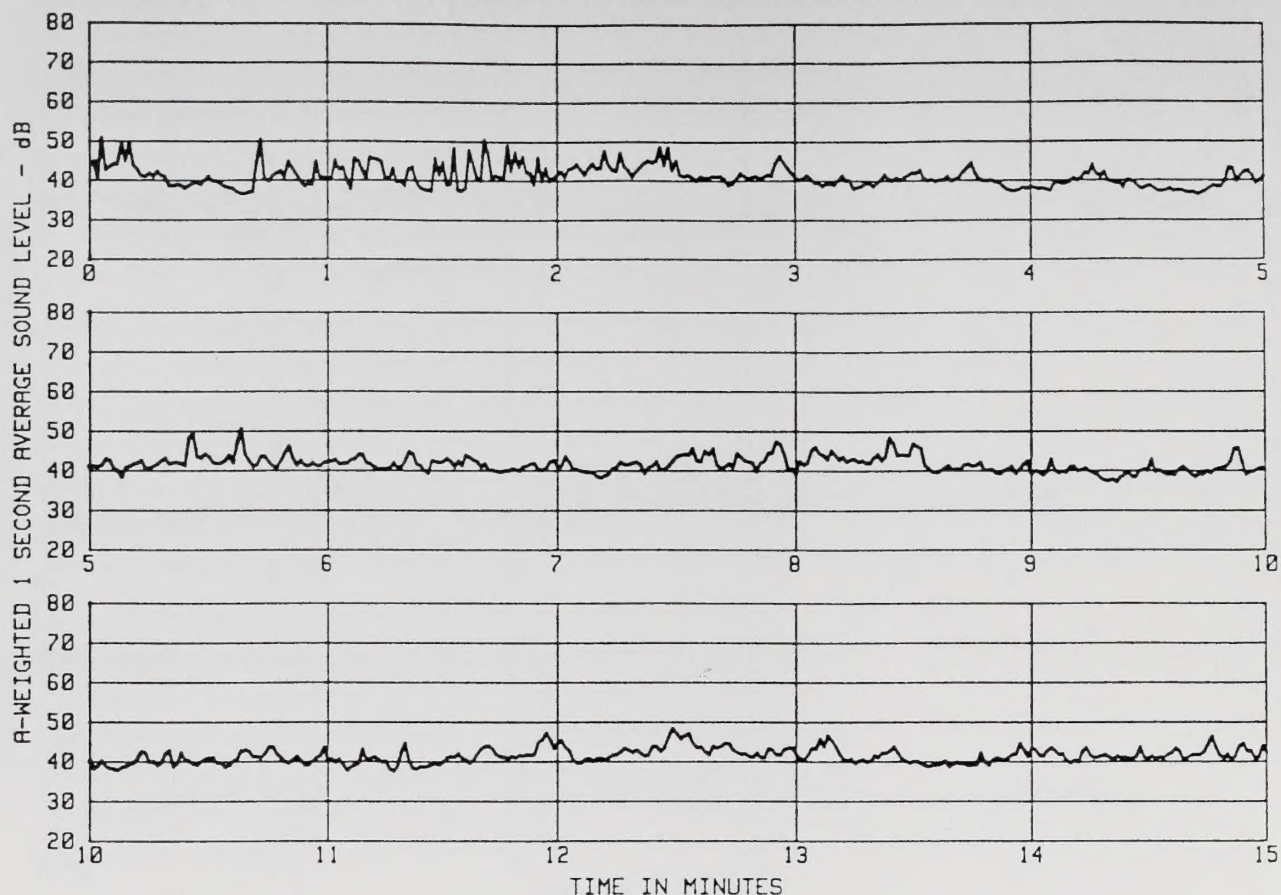
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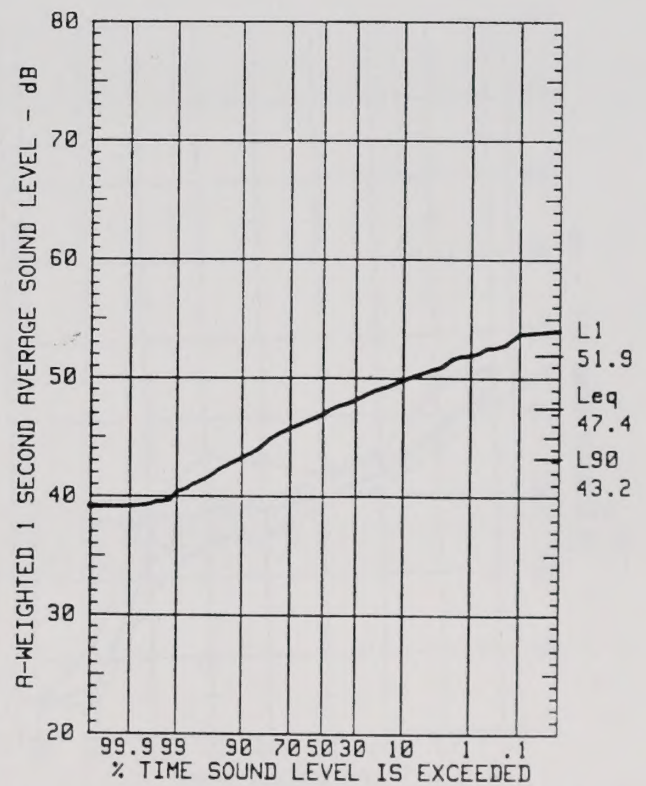
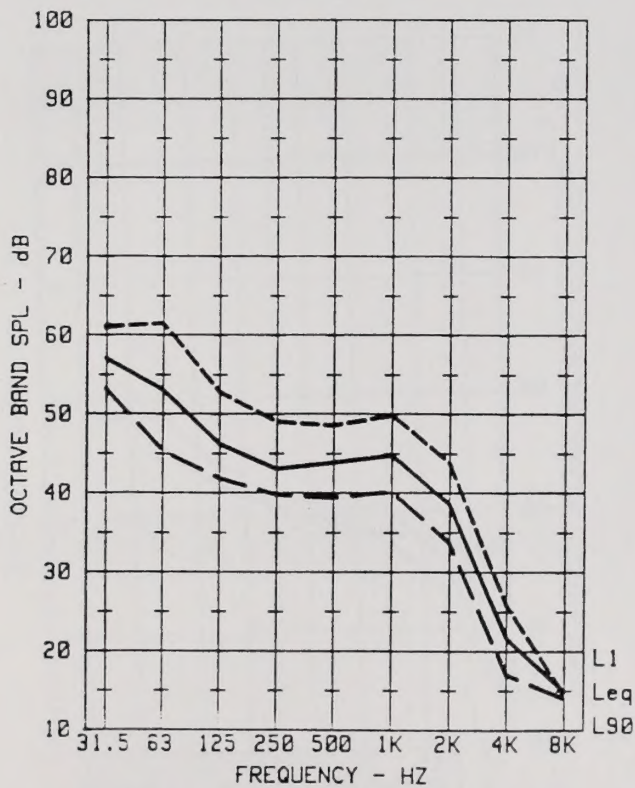
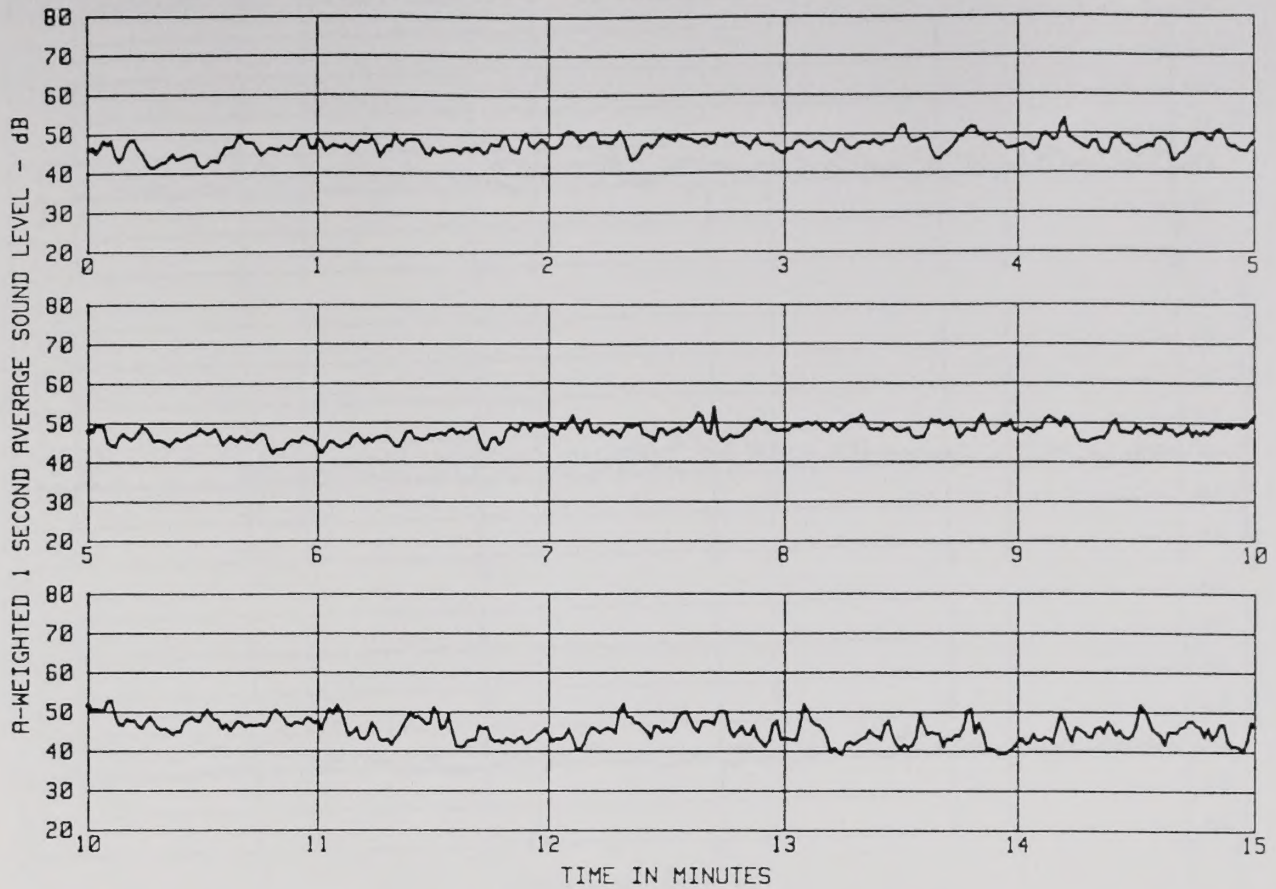
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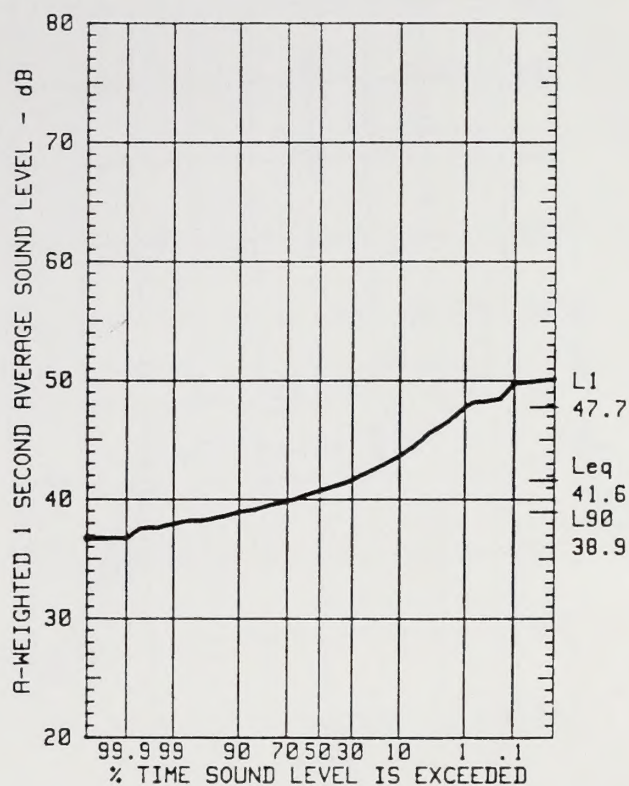
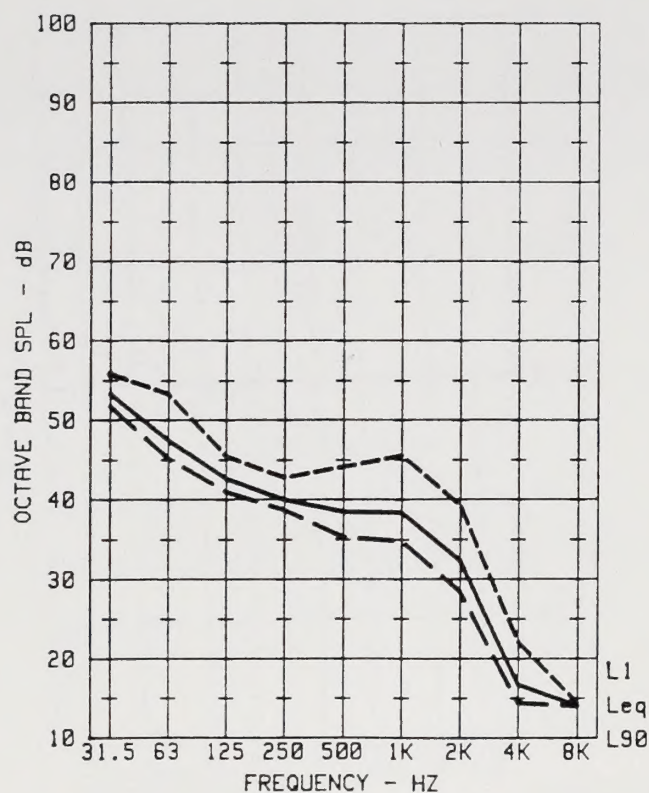
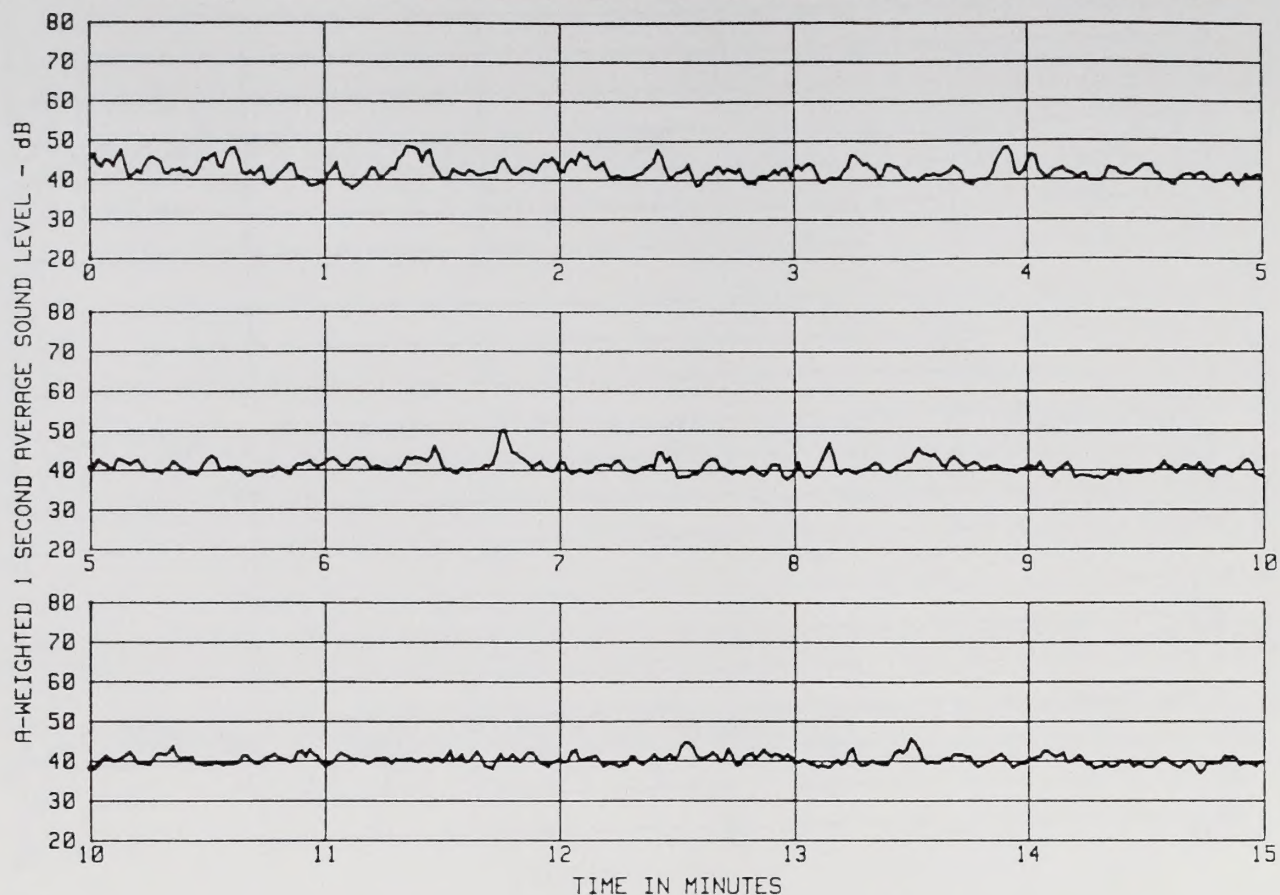
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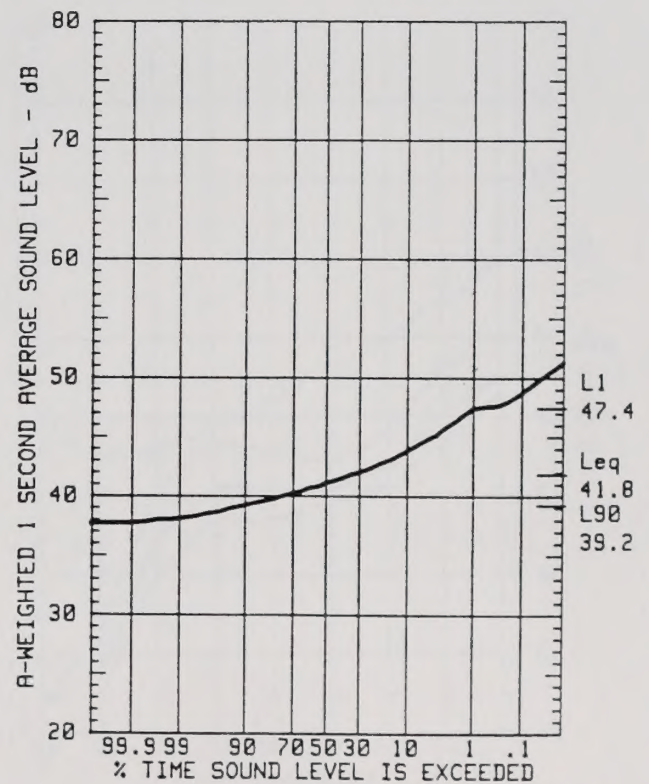
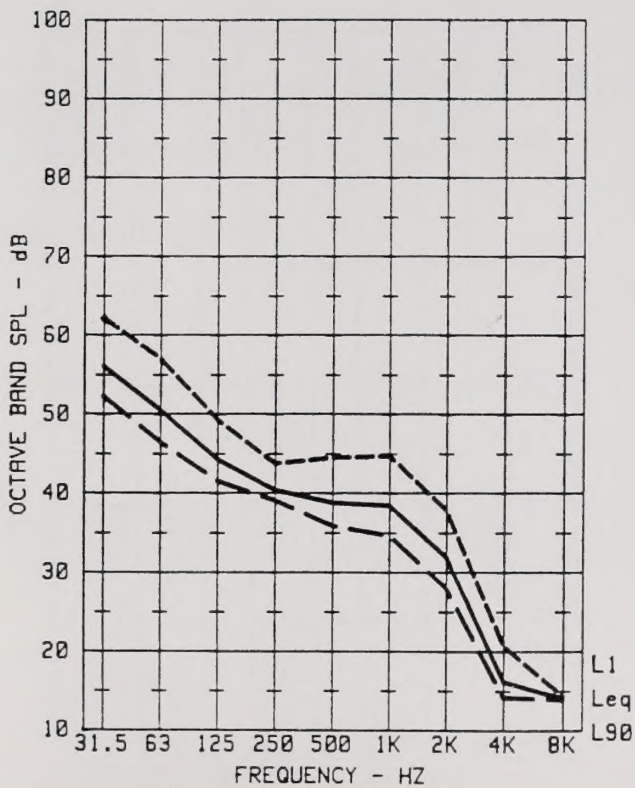
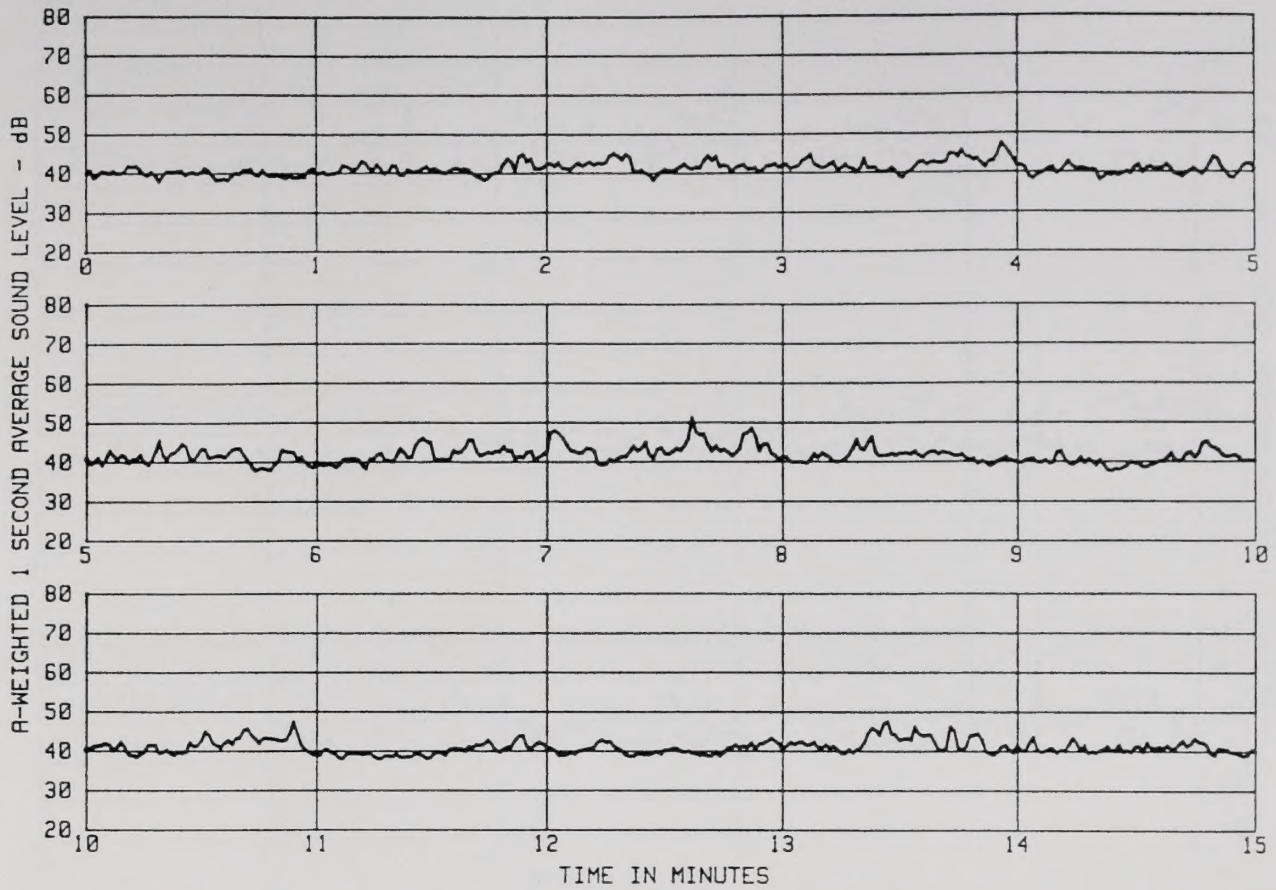
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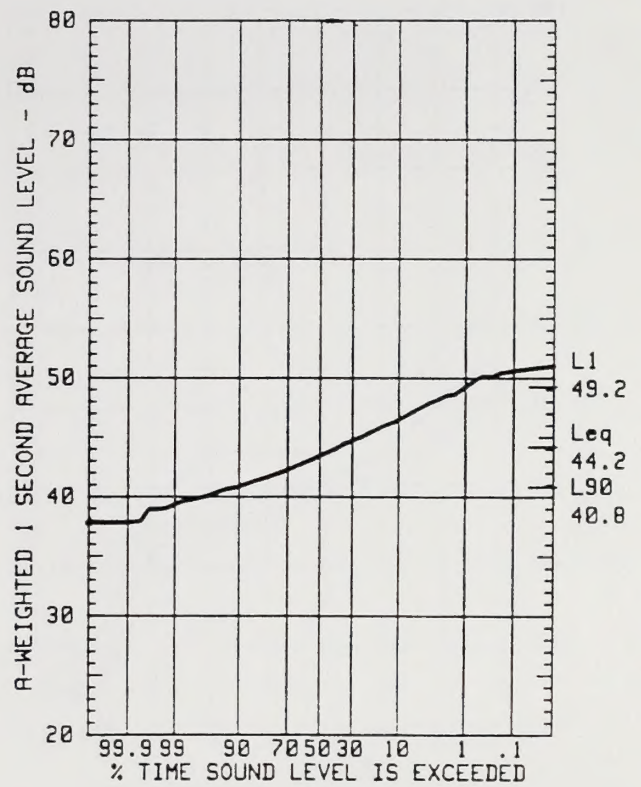
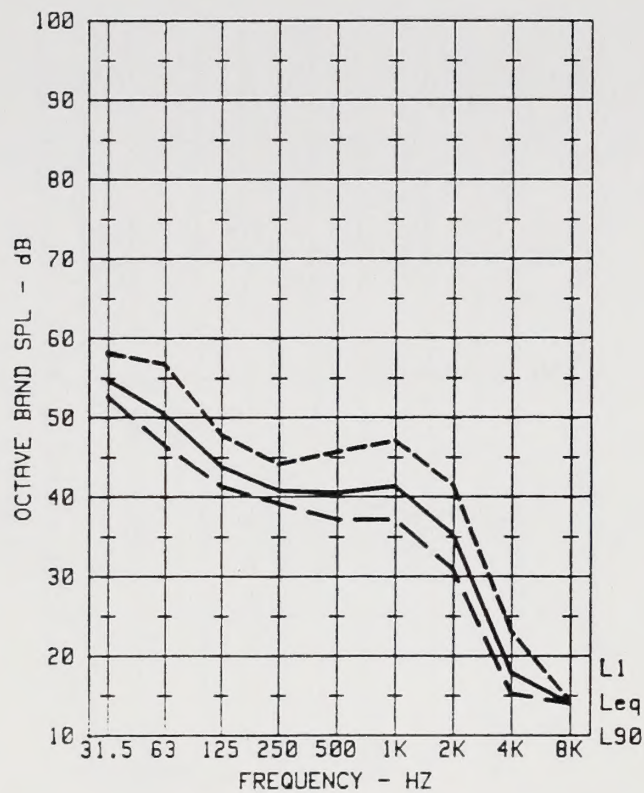
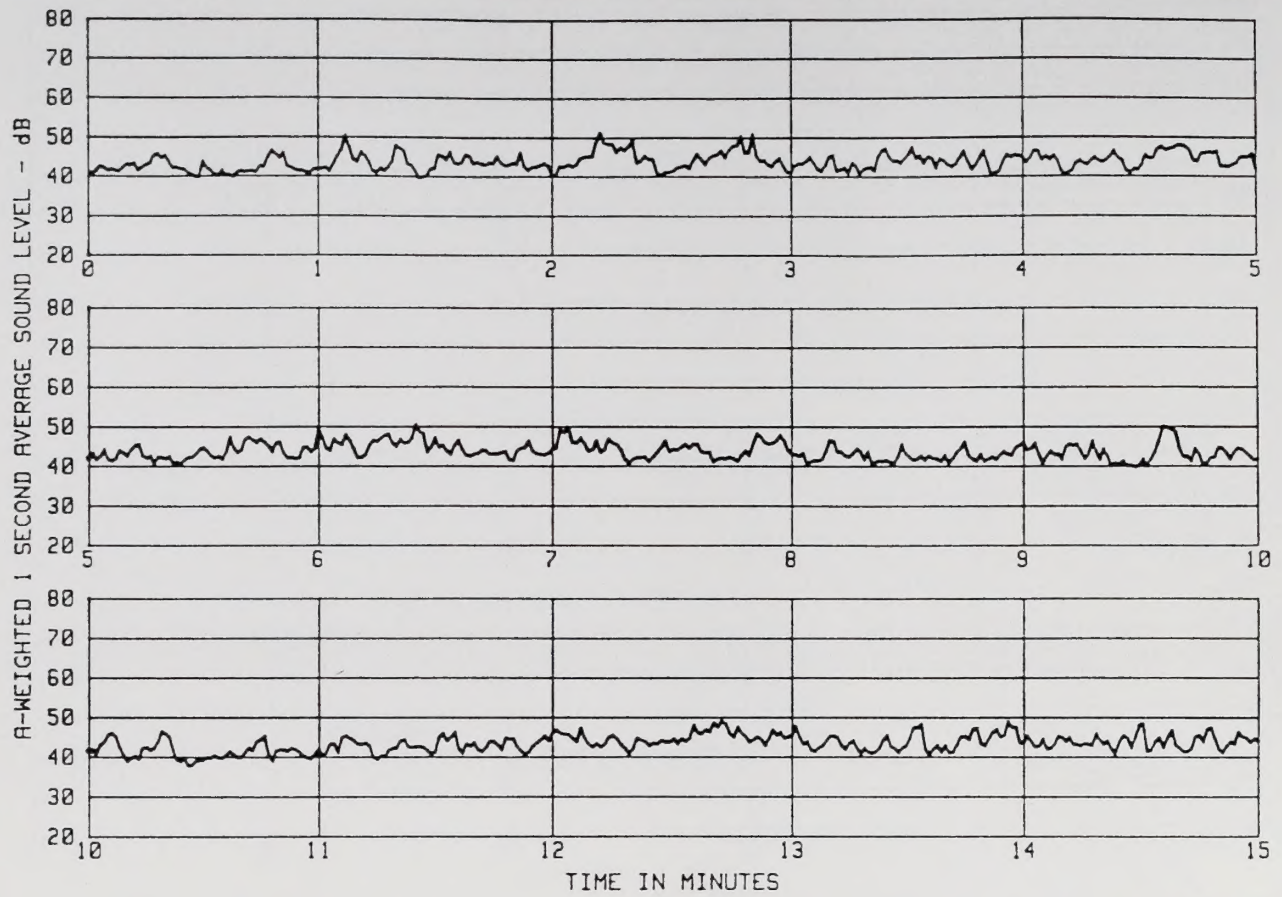
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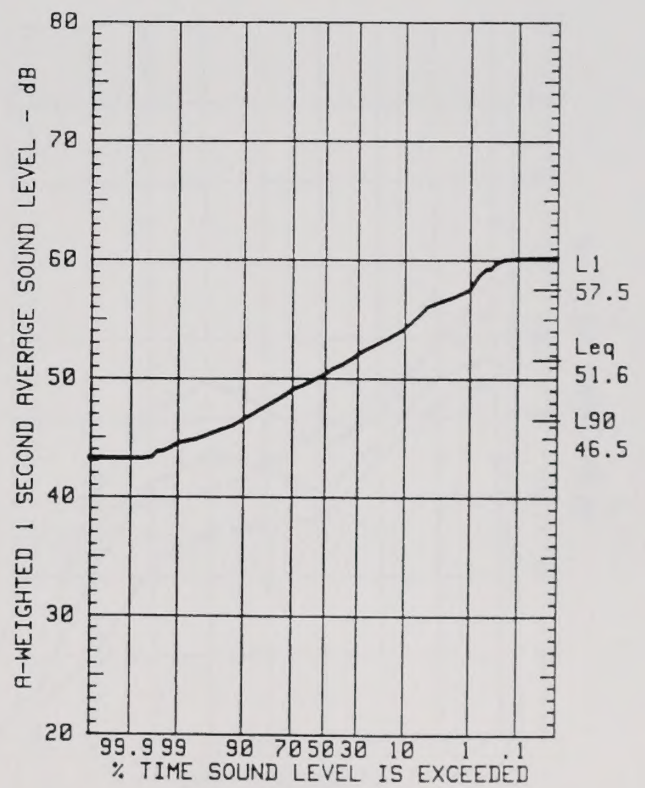
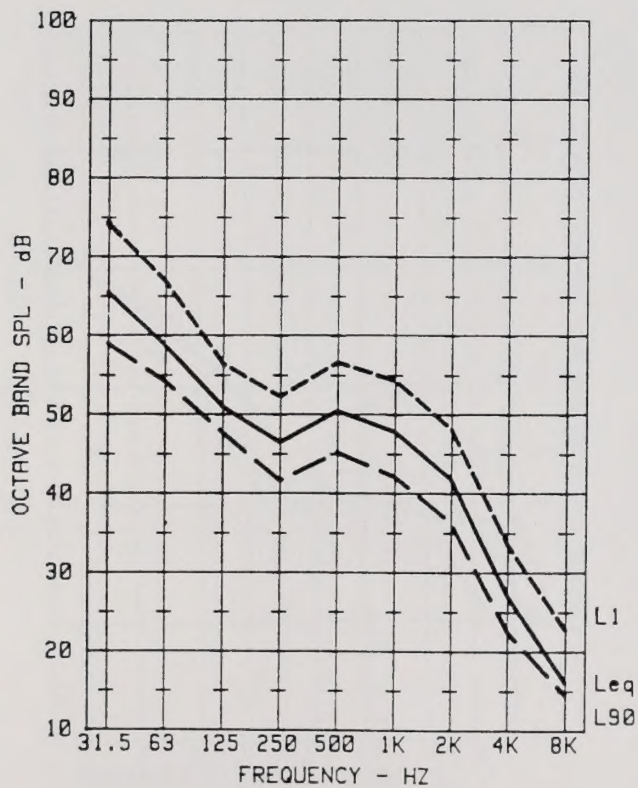
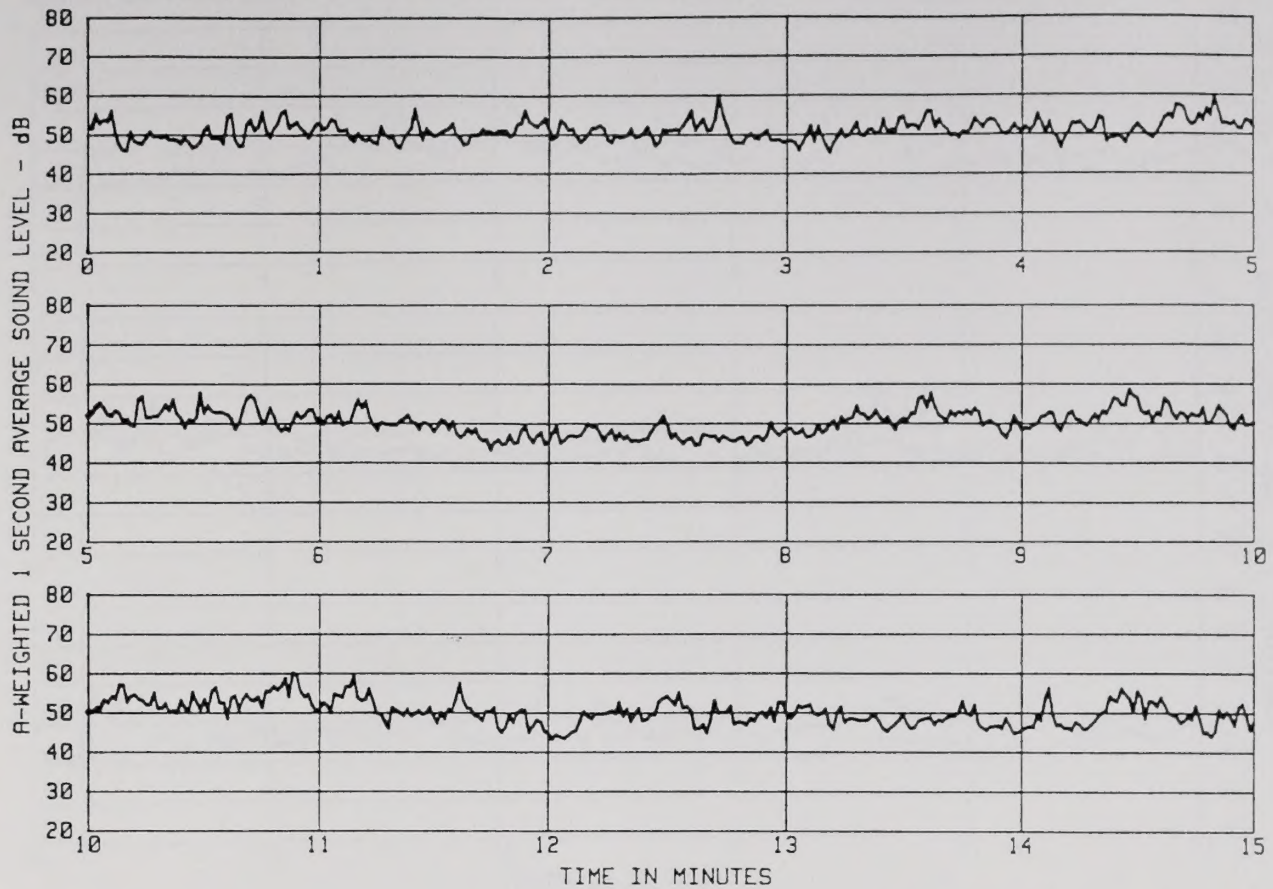
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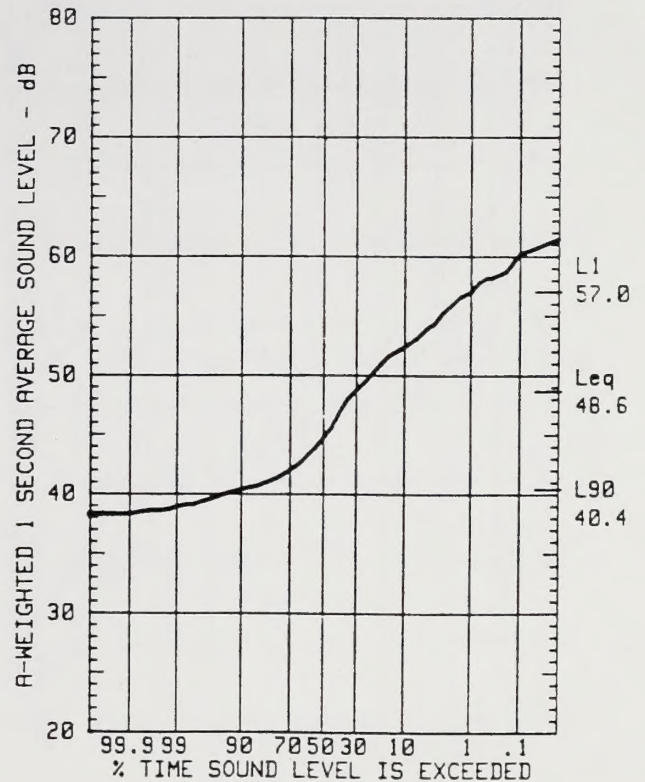
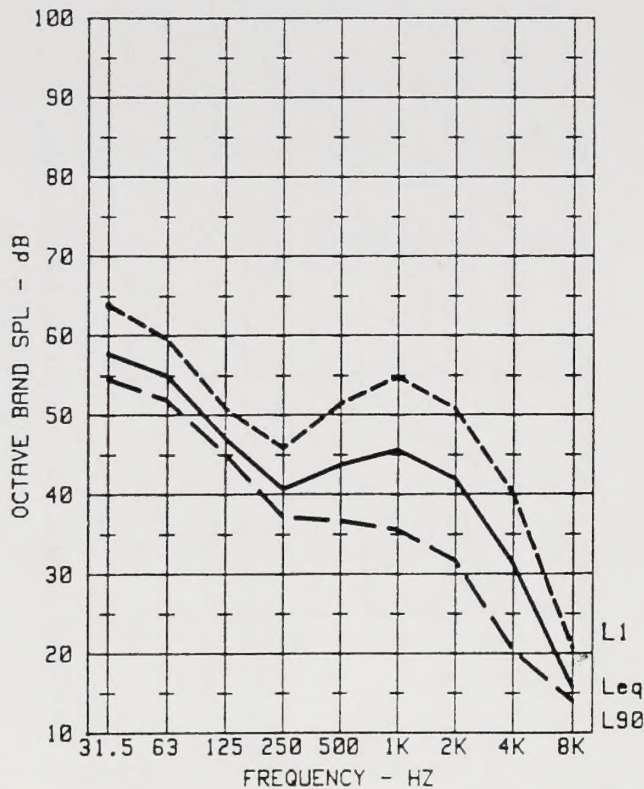
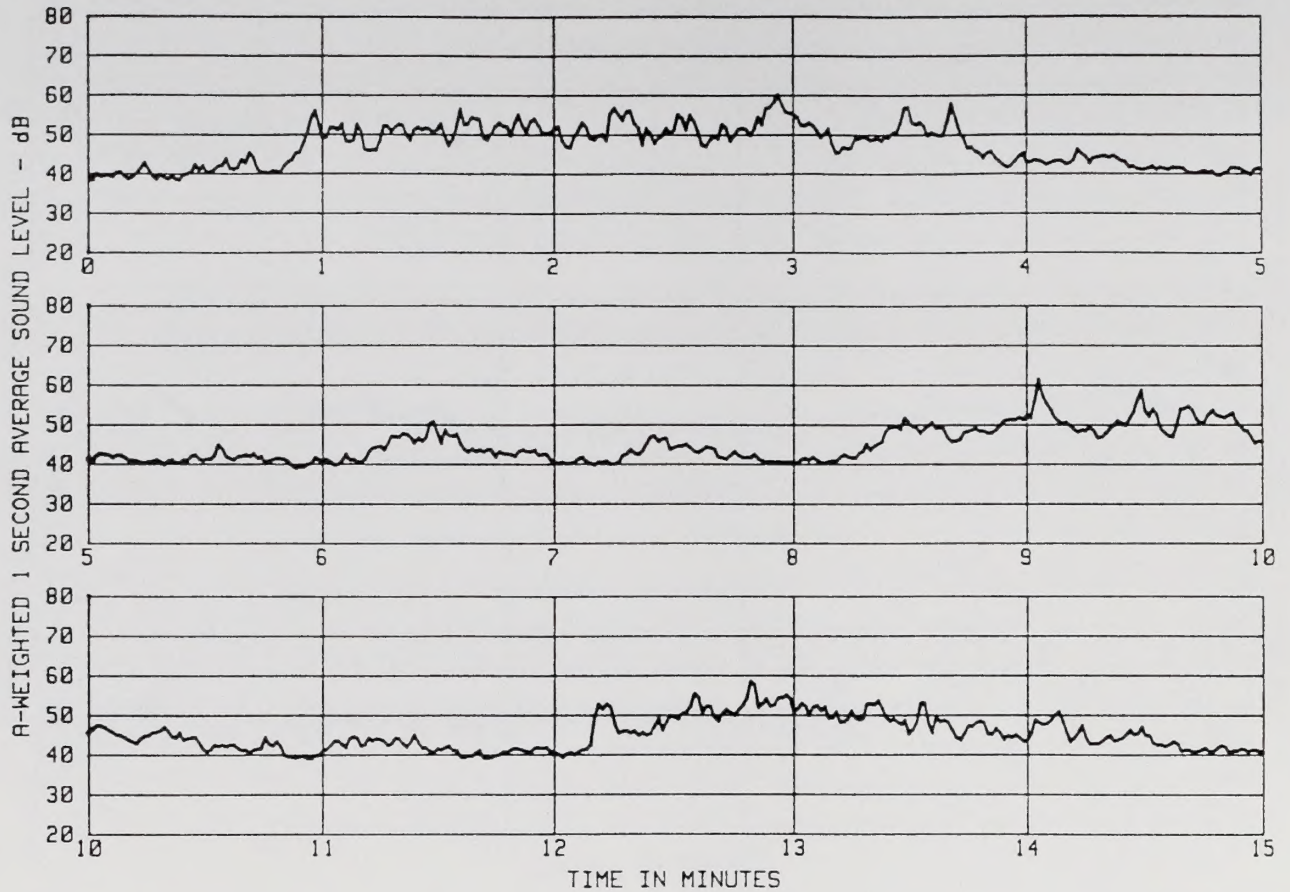
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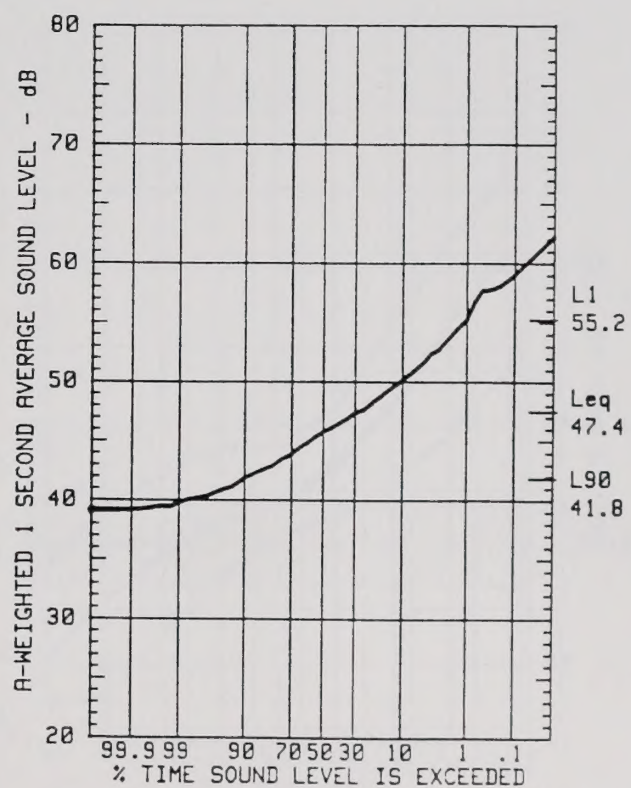
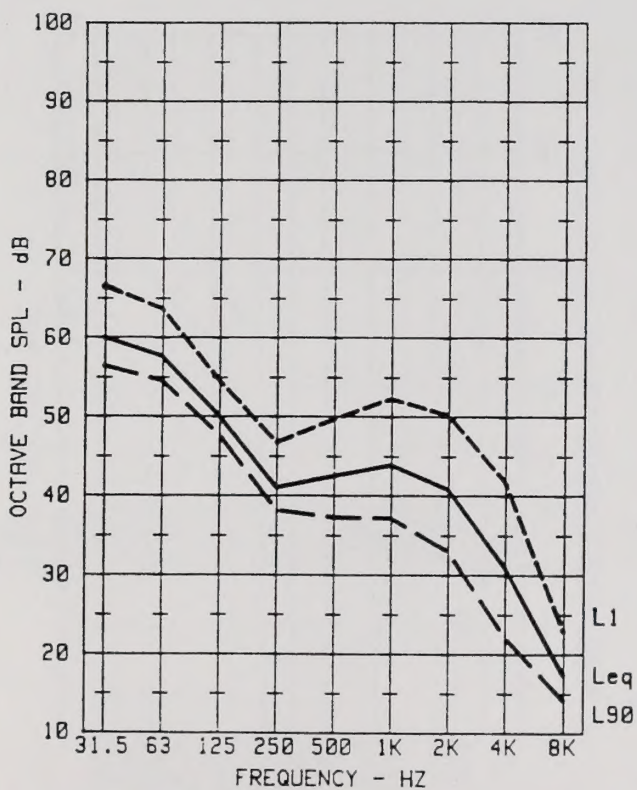
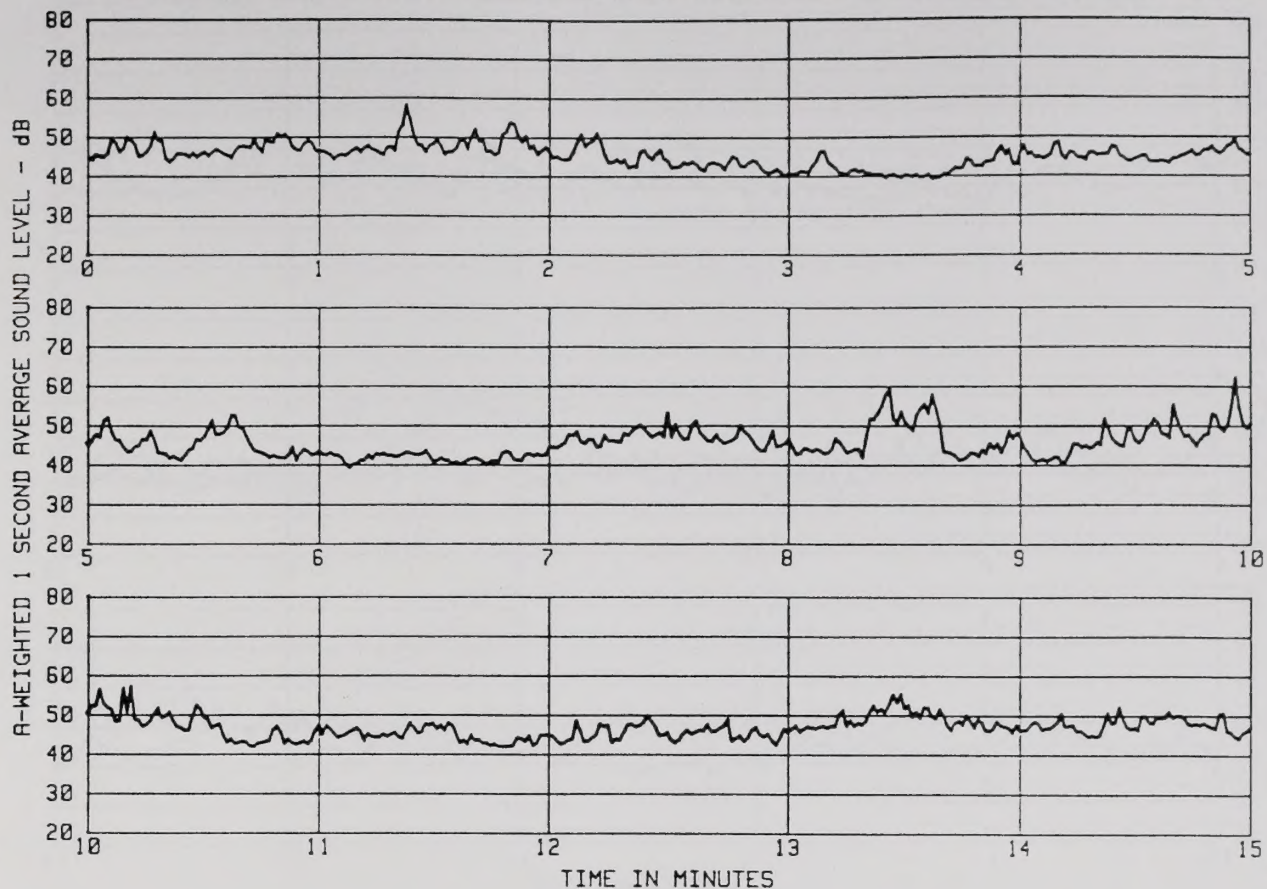
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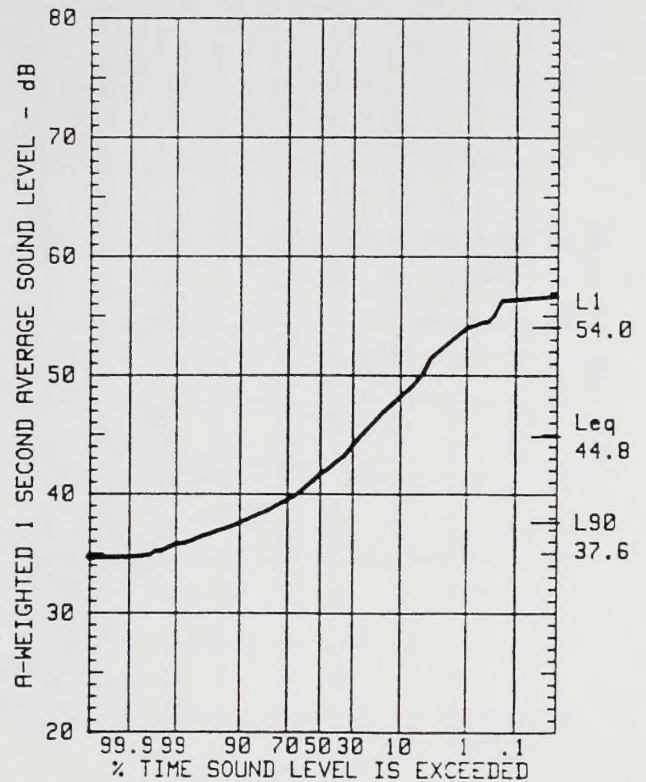
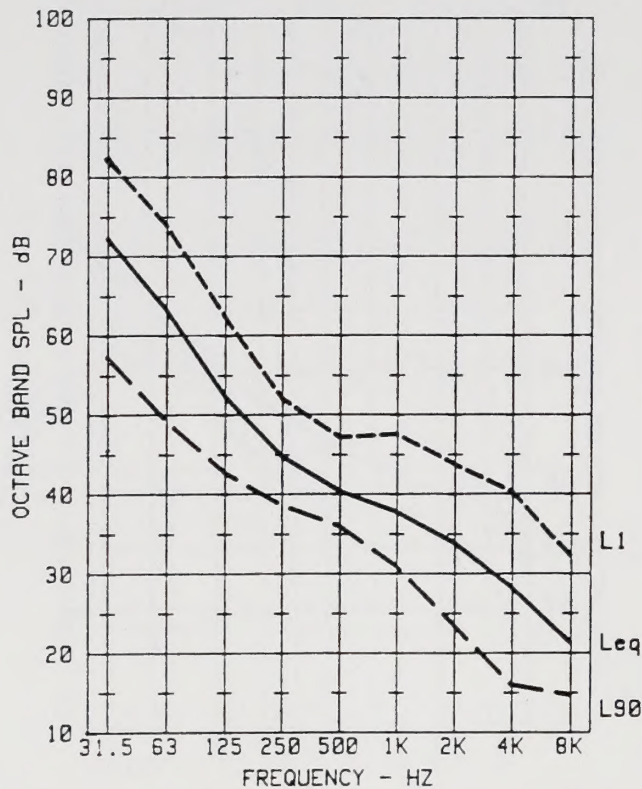
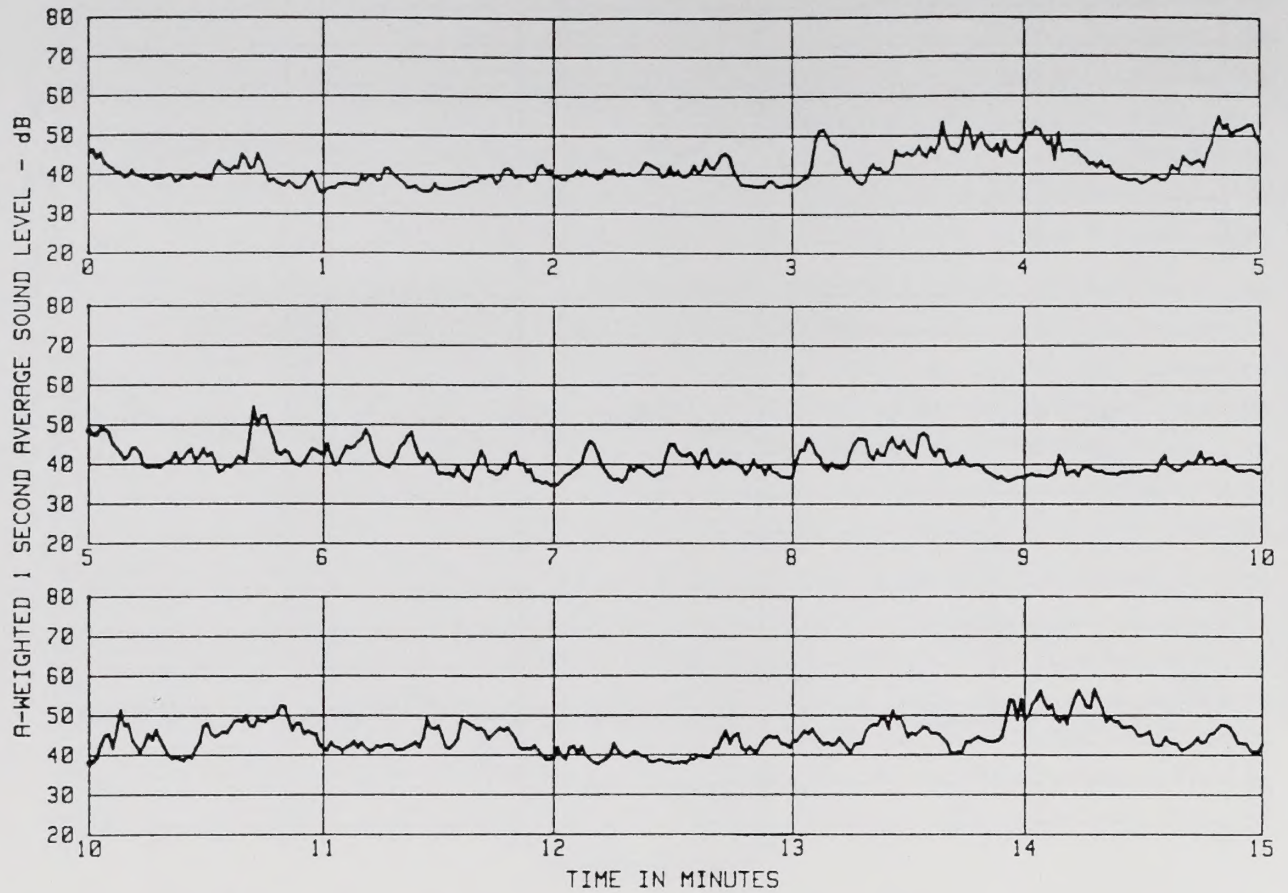
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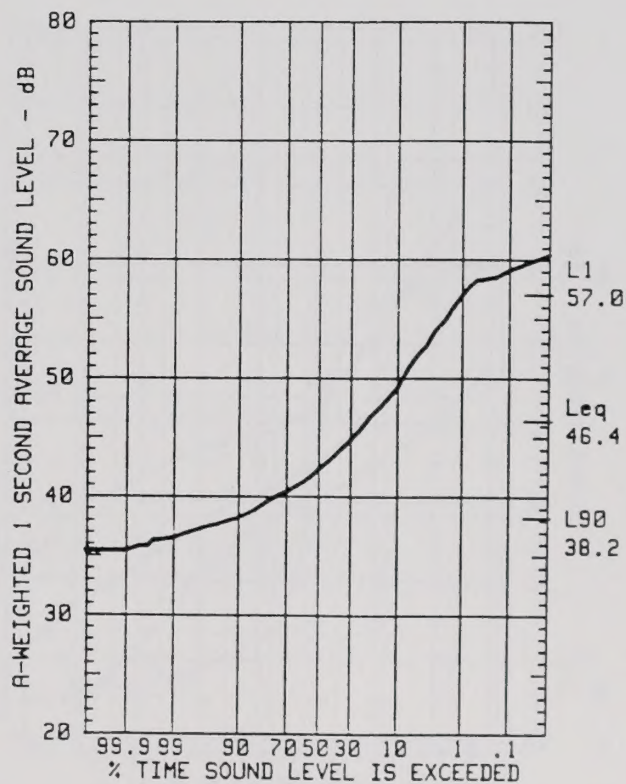
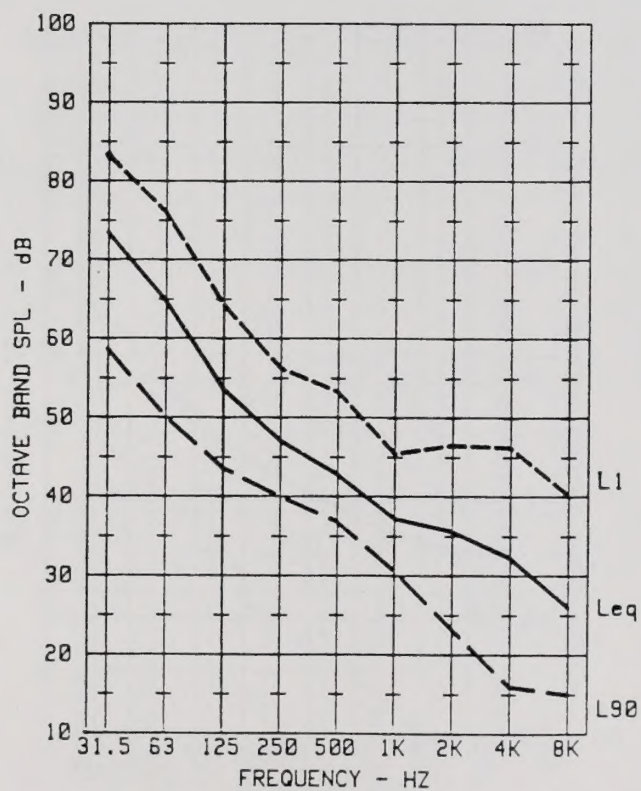
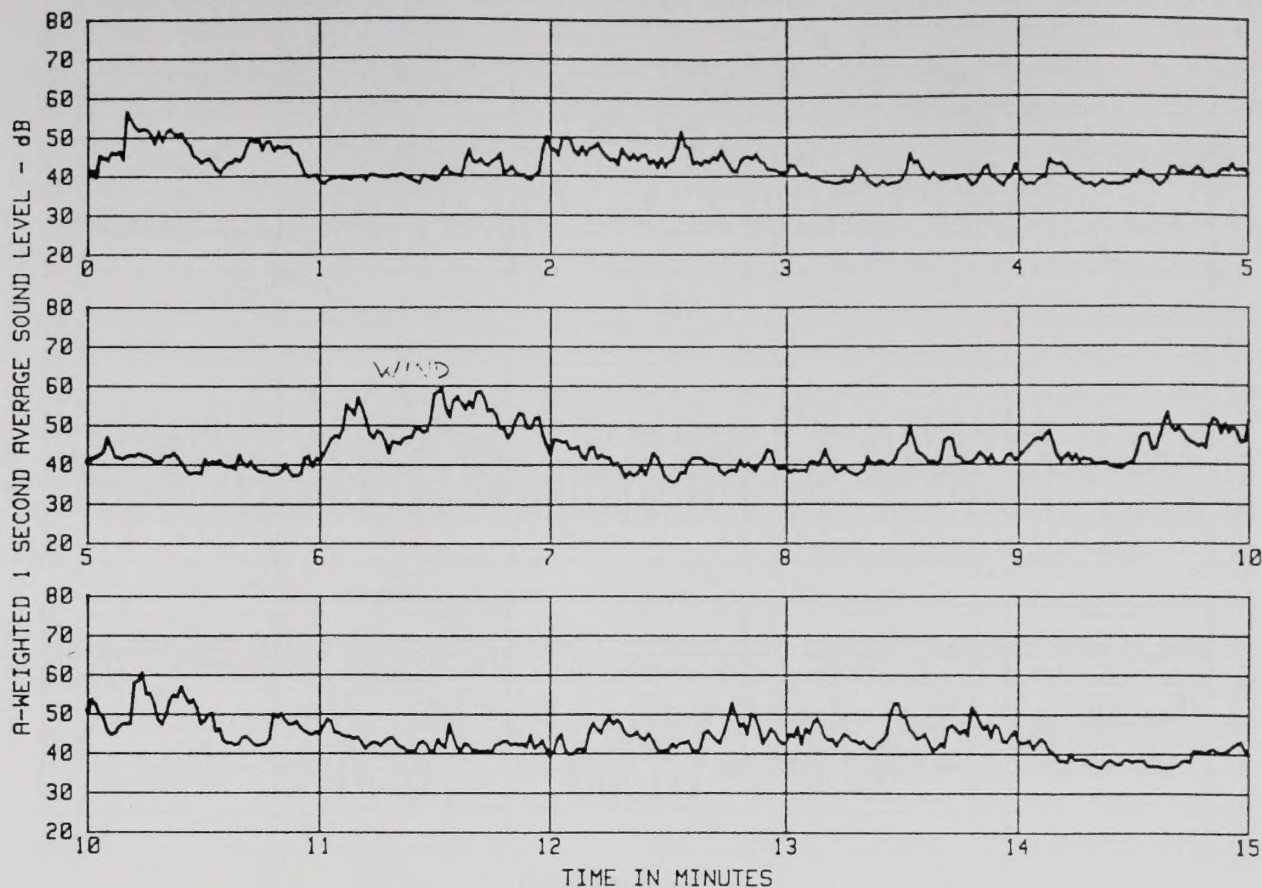
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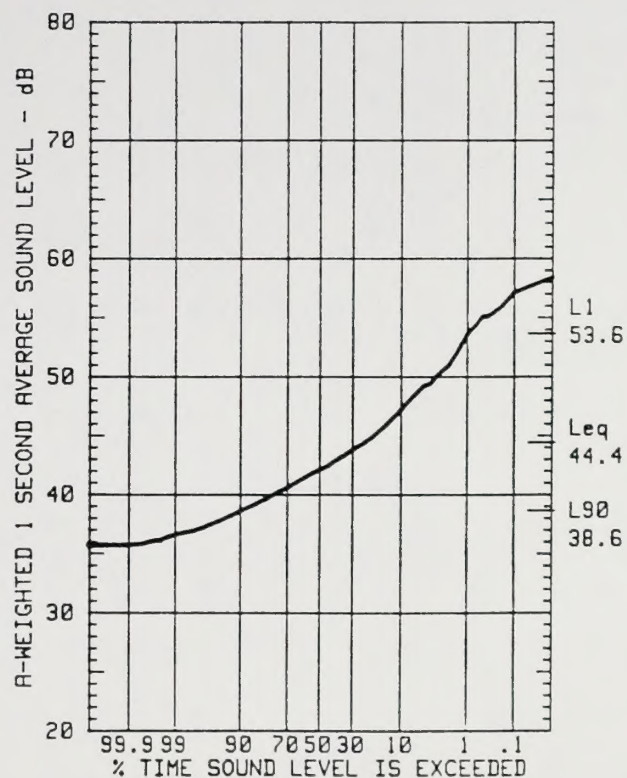
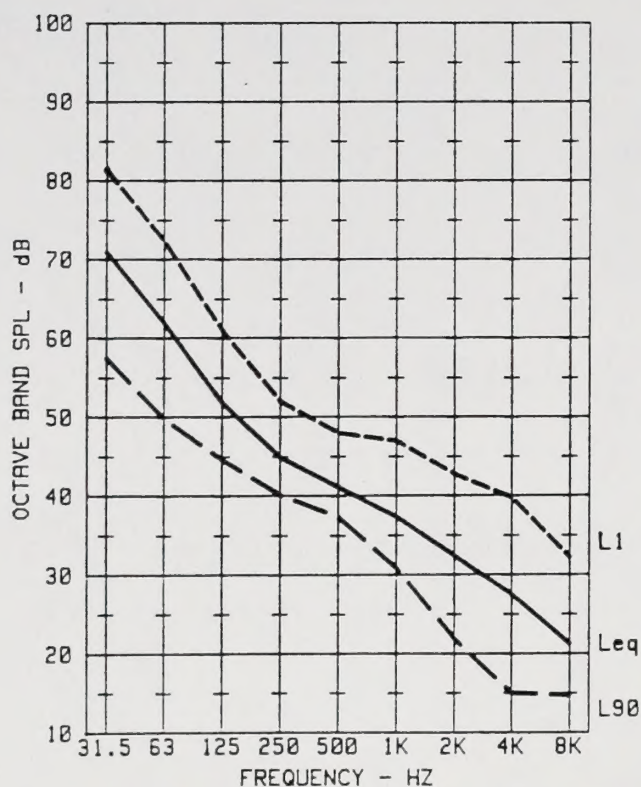
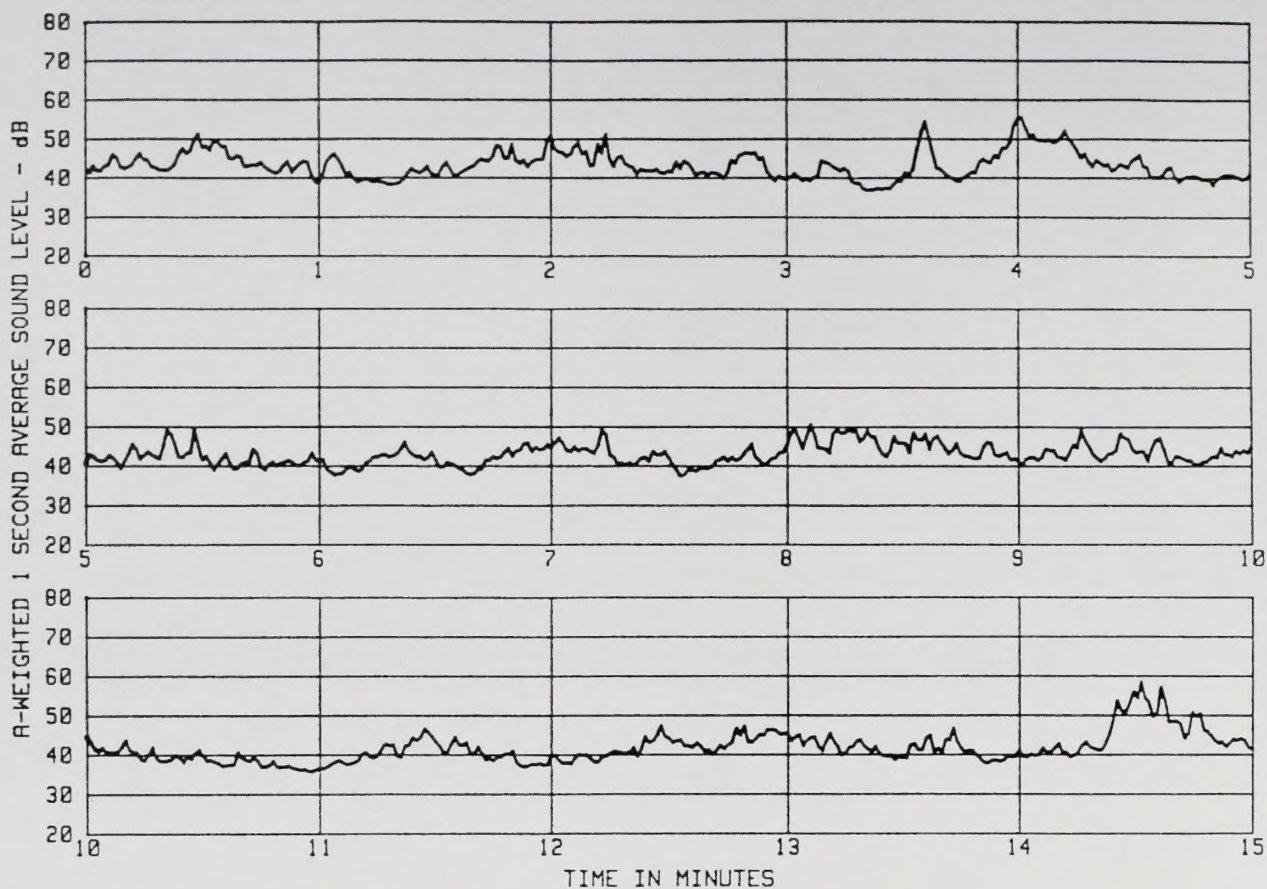
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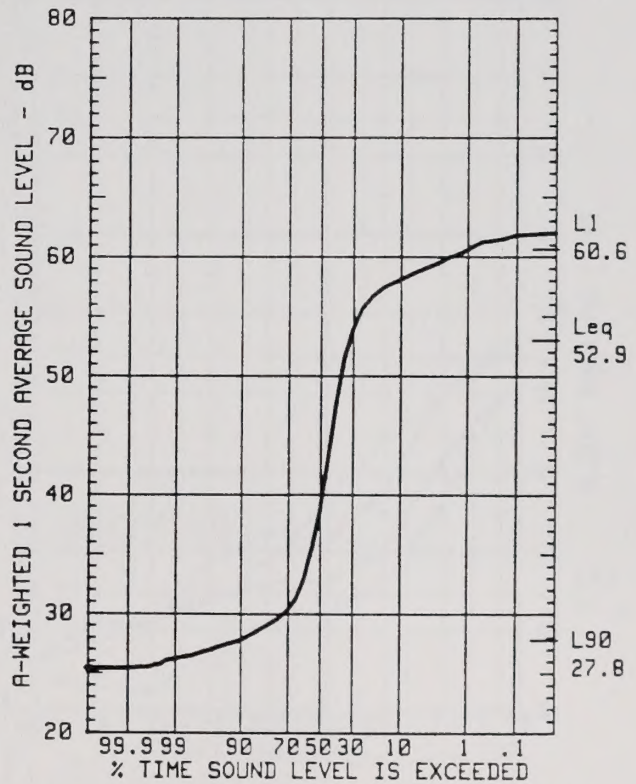
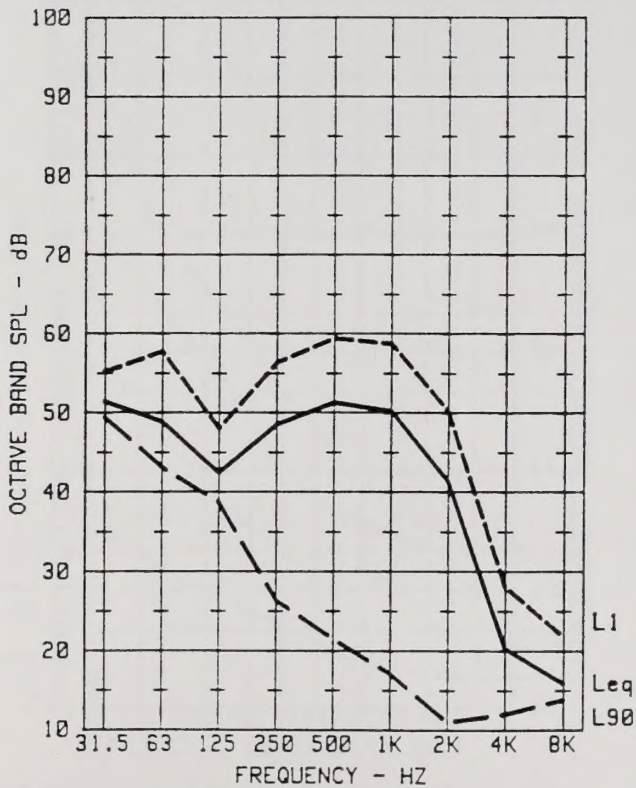
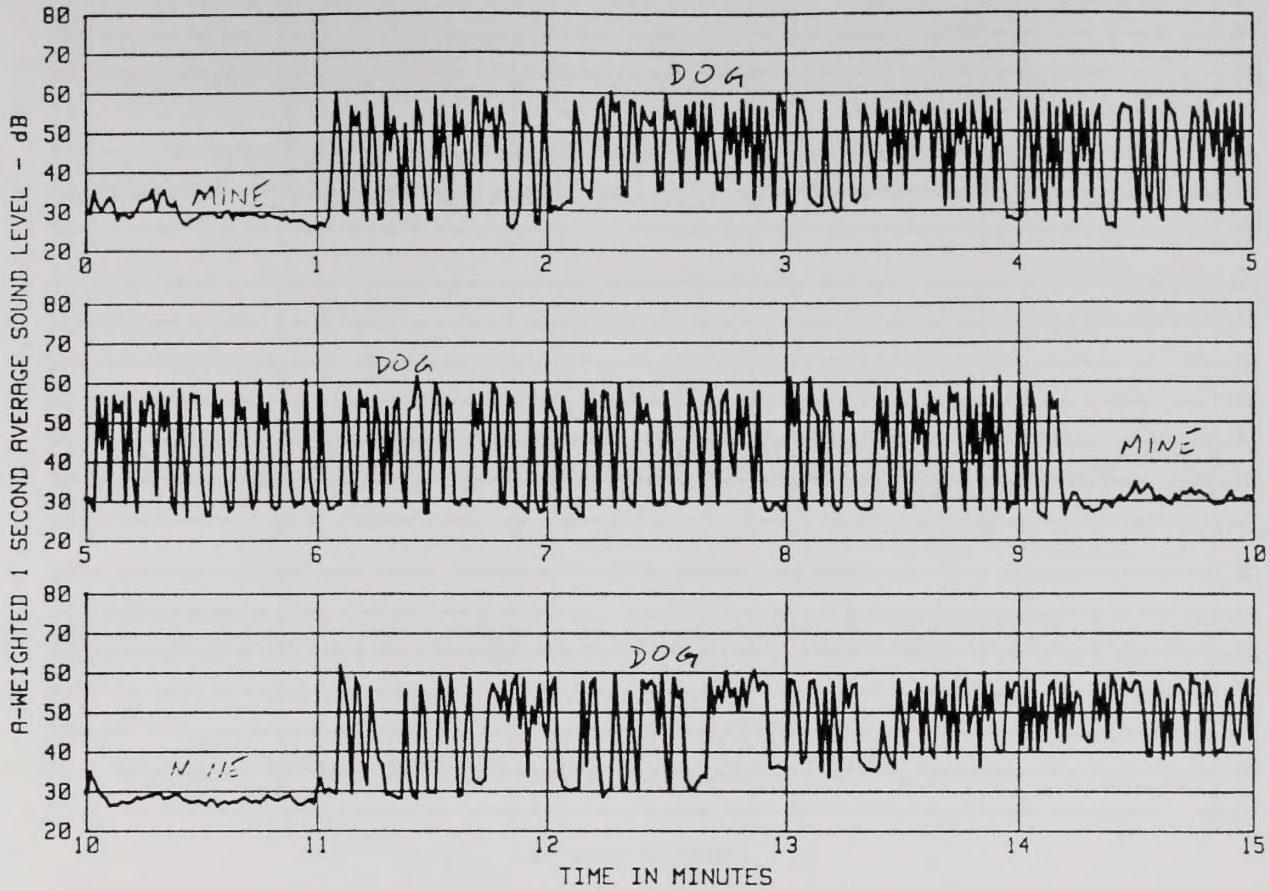
RAND MINING BAL TIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 NORTHERLY END OF OLD BUTTE AT FENCE LINE
 03-16-1994 12:40-12:55

WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



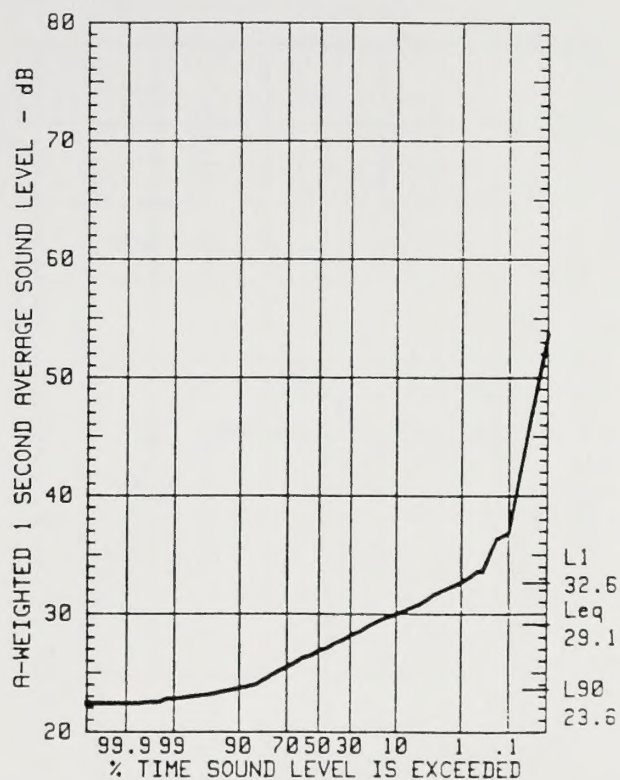
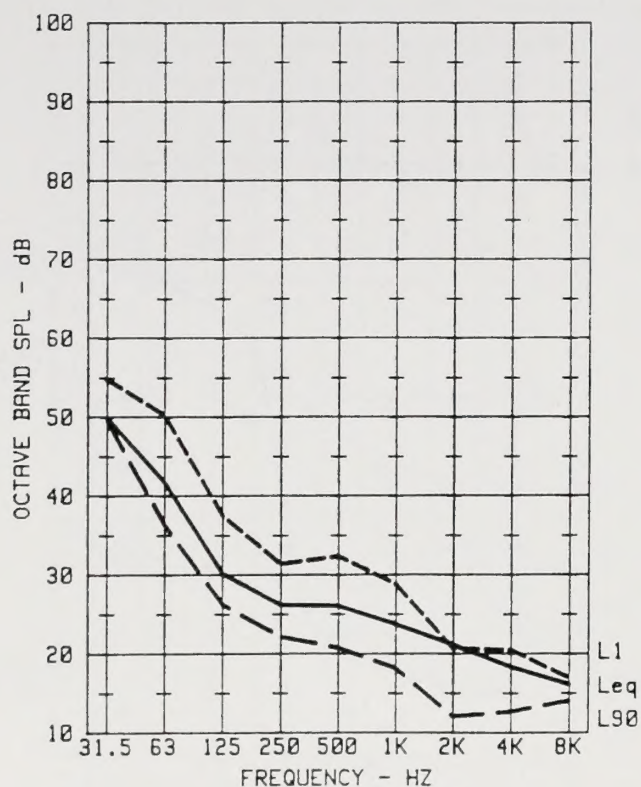
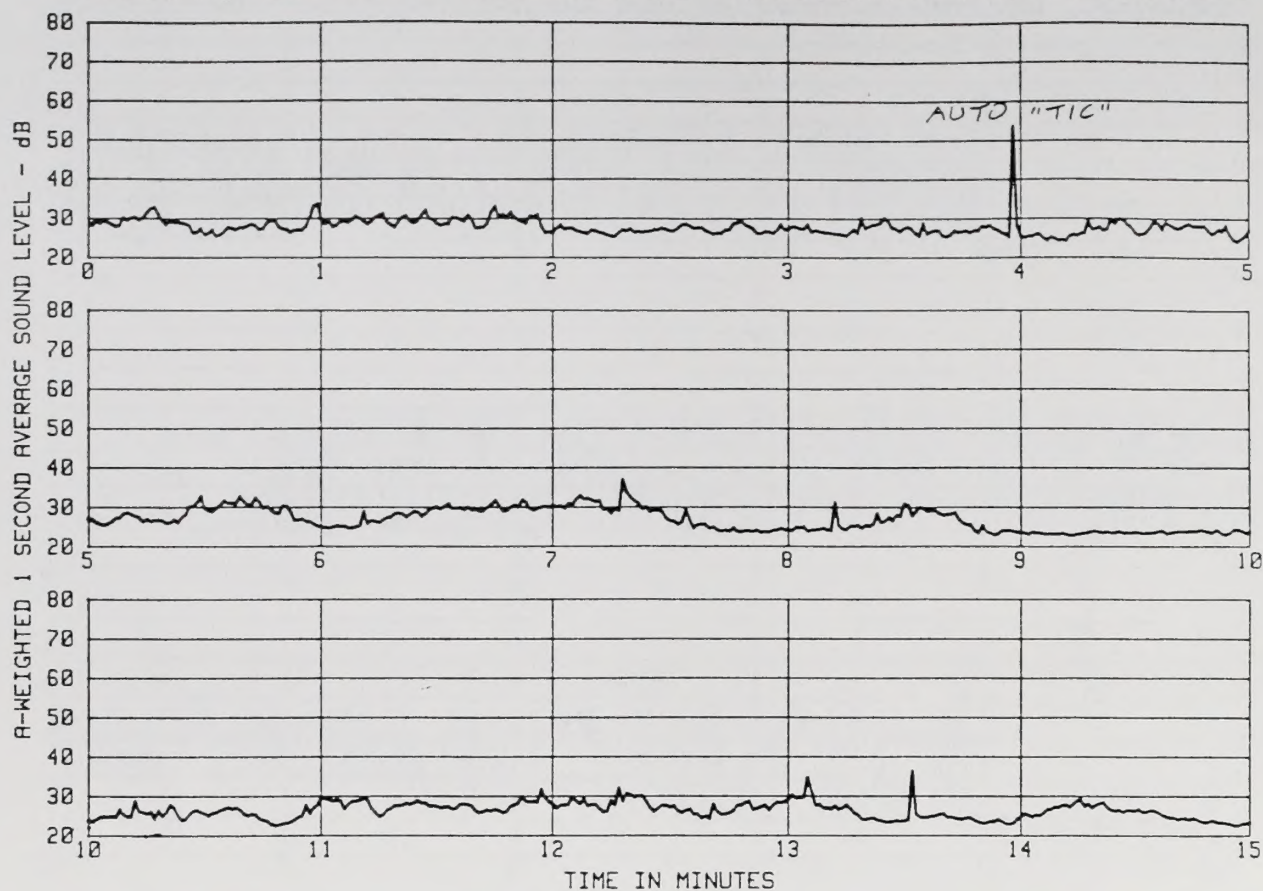
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 NORTHERLY END OF OLD BUTTE AT FENCE LINE
 03-16-1994 12:59-13:14

WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



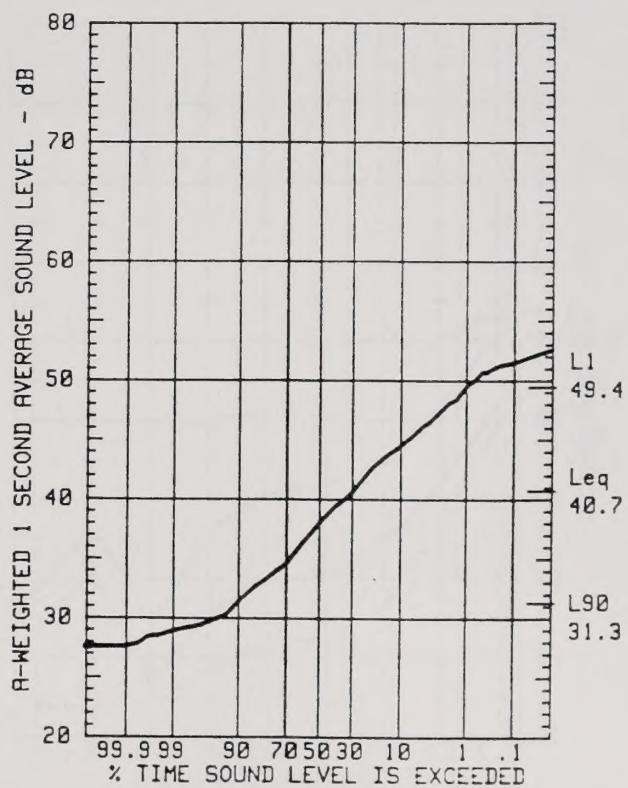
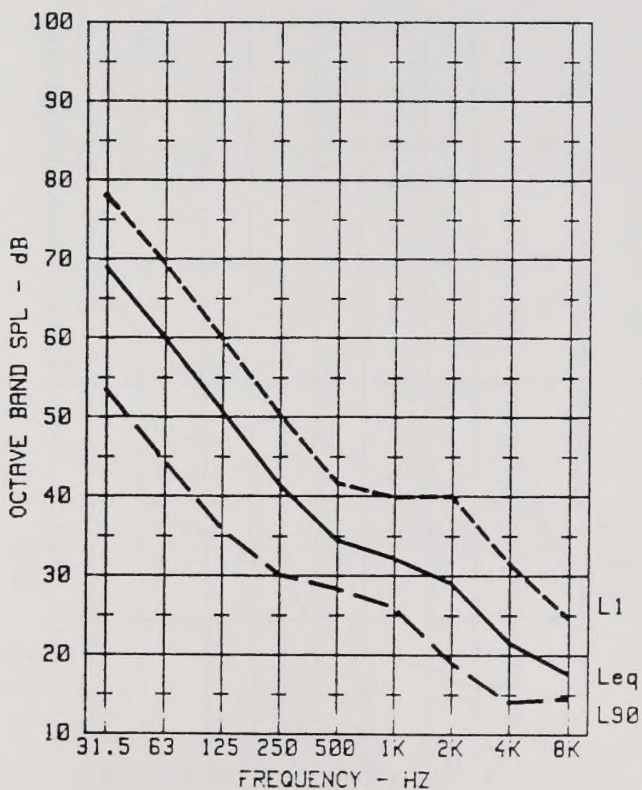
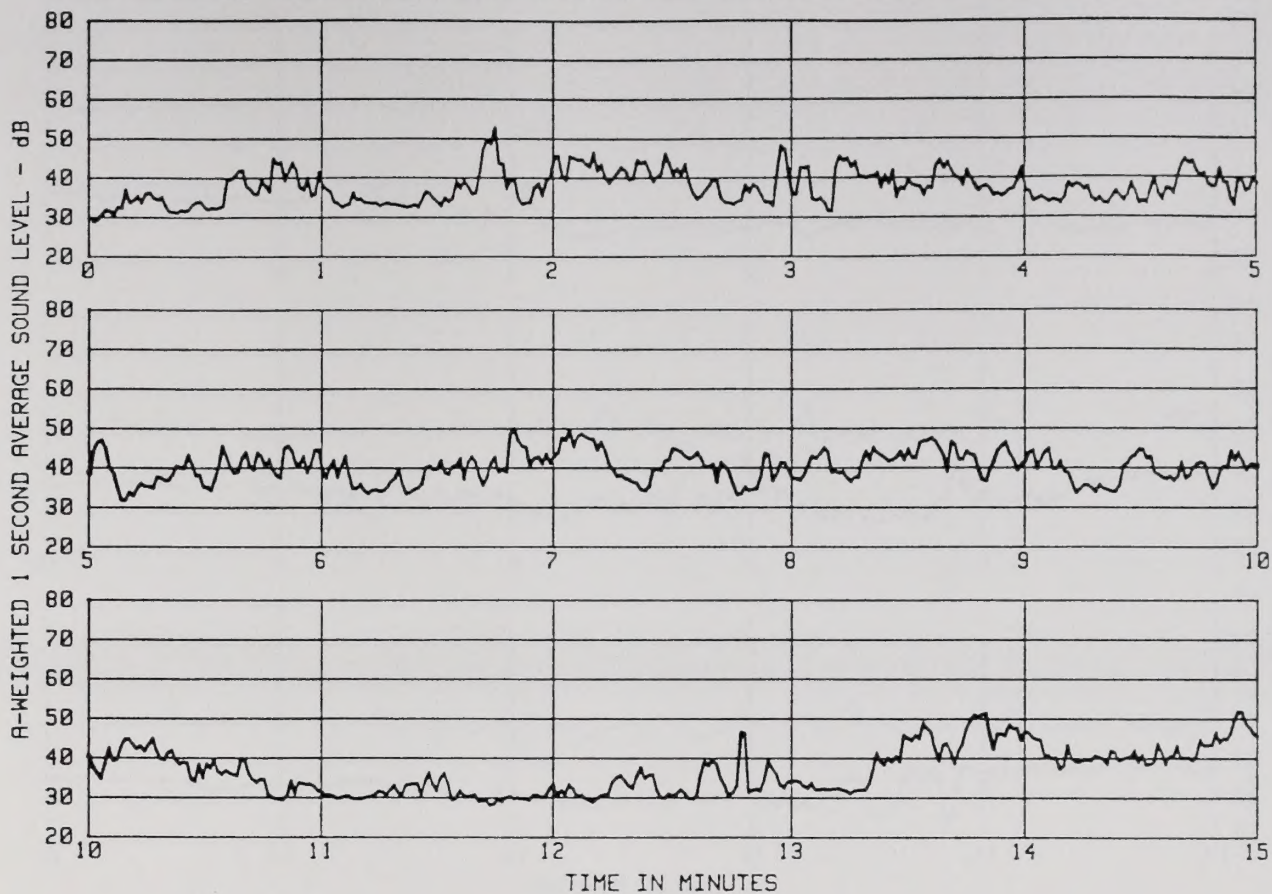
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



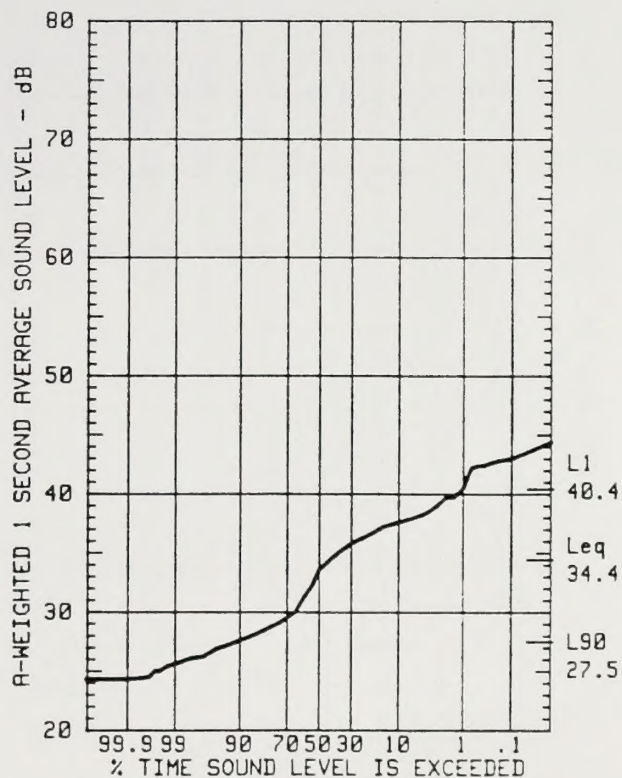
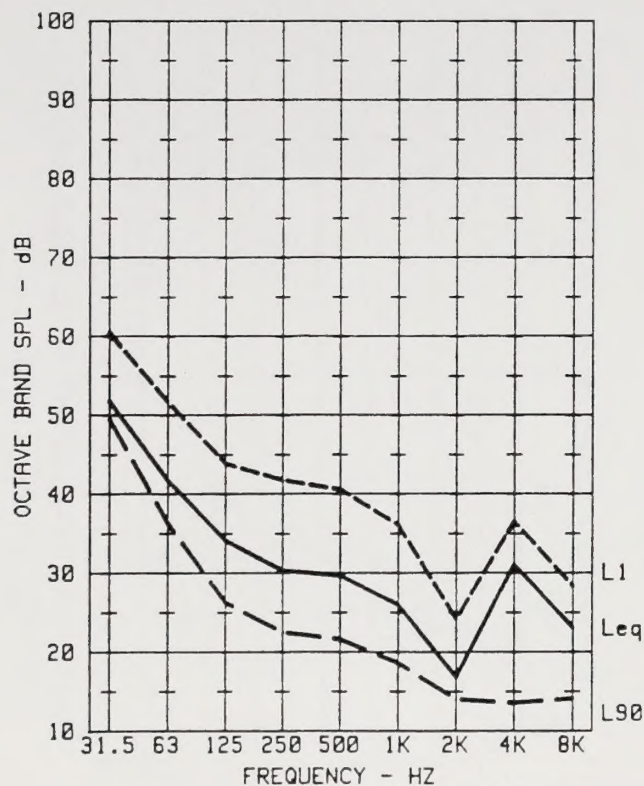
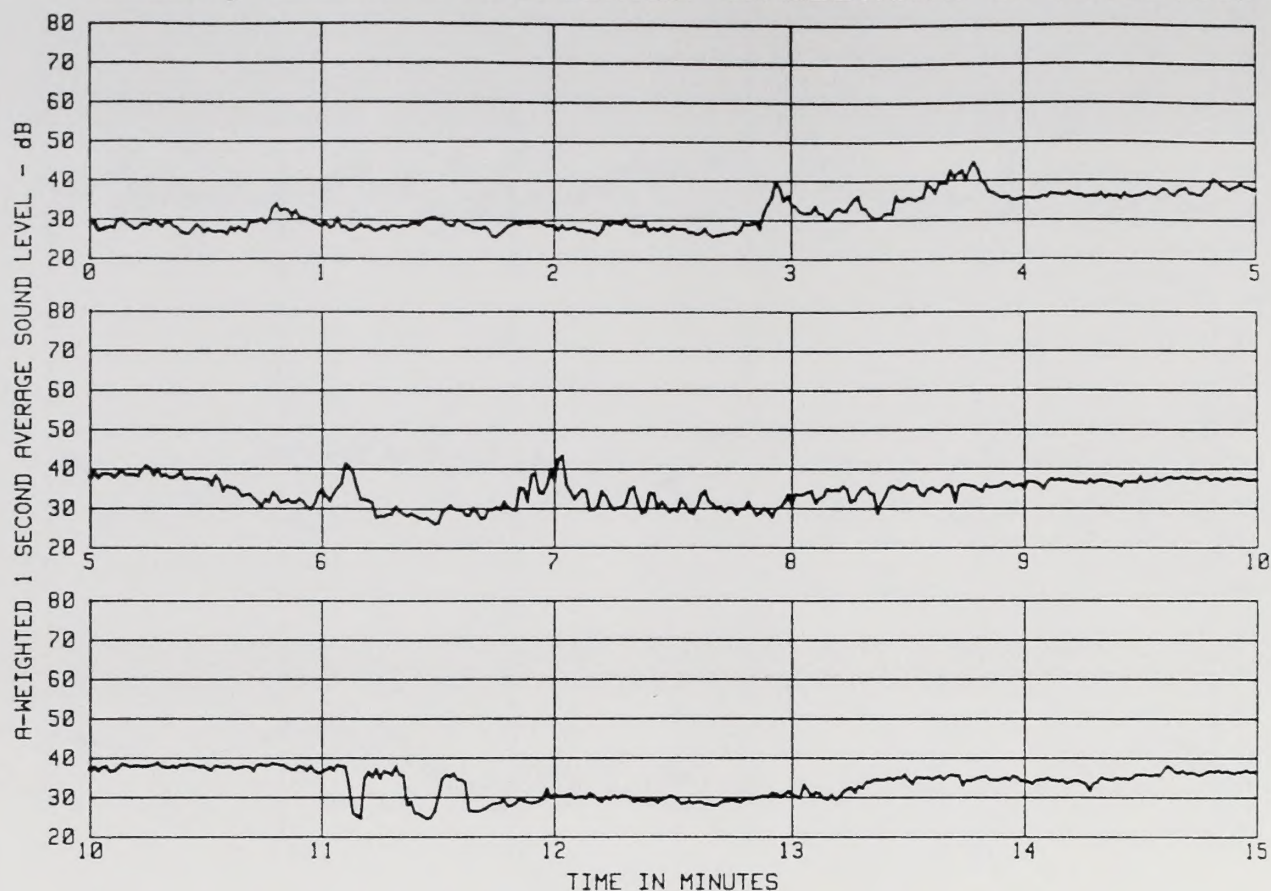
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 INTERSECTION OF OSDICK & OLD BUTTE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



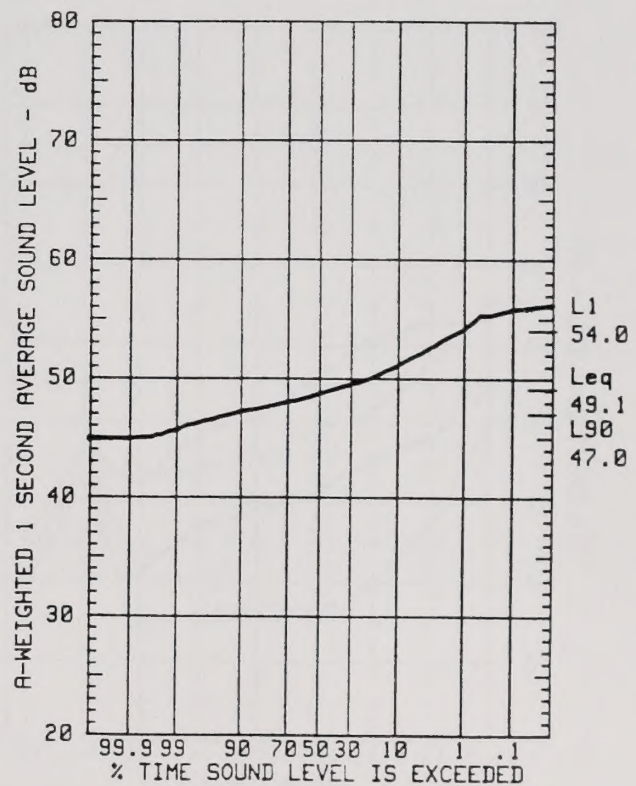
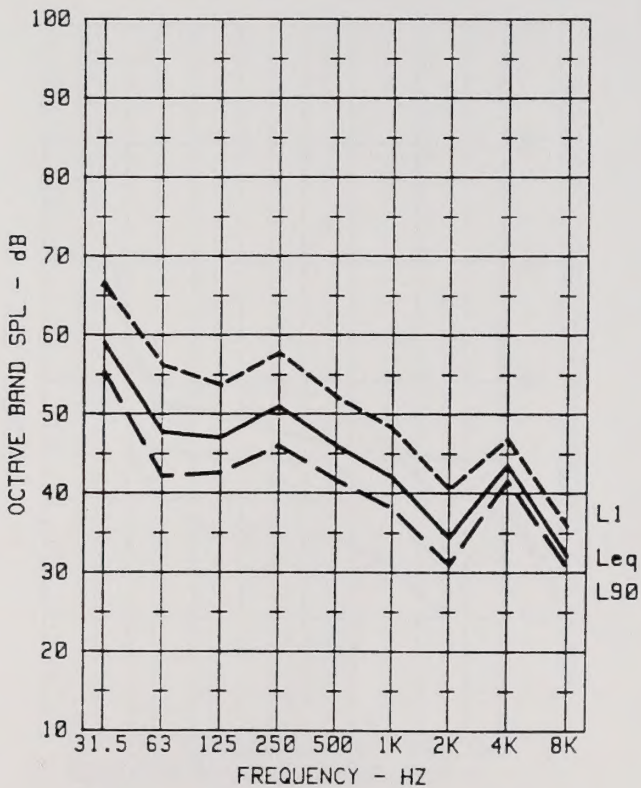
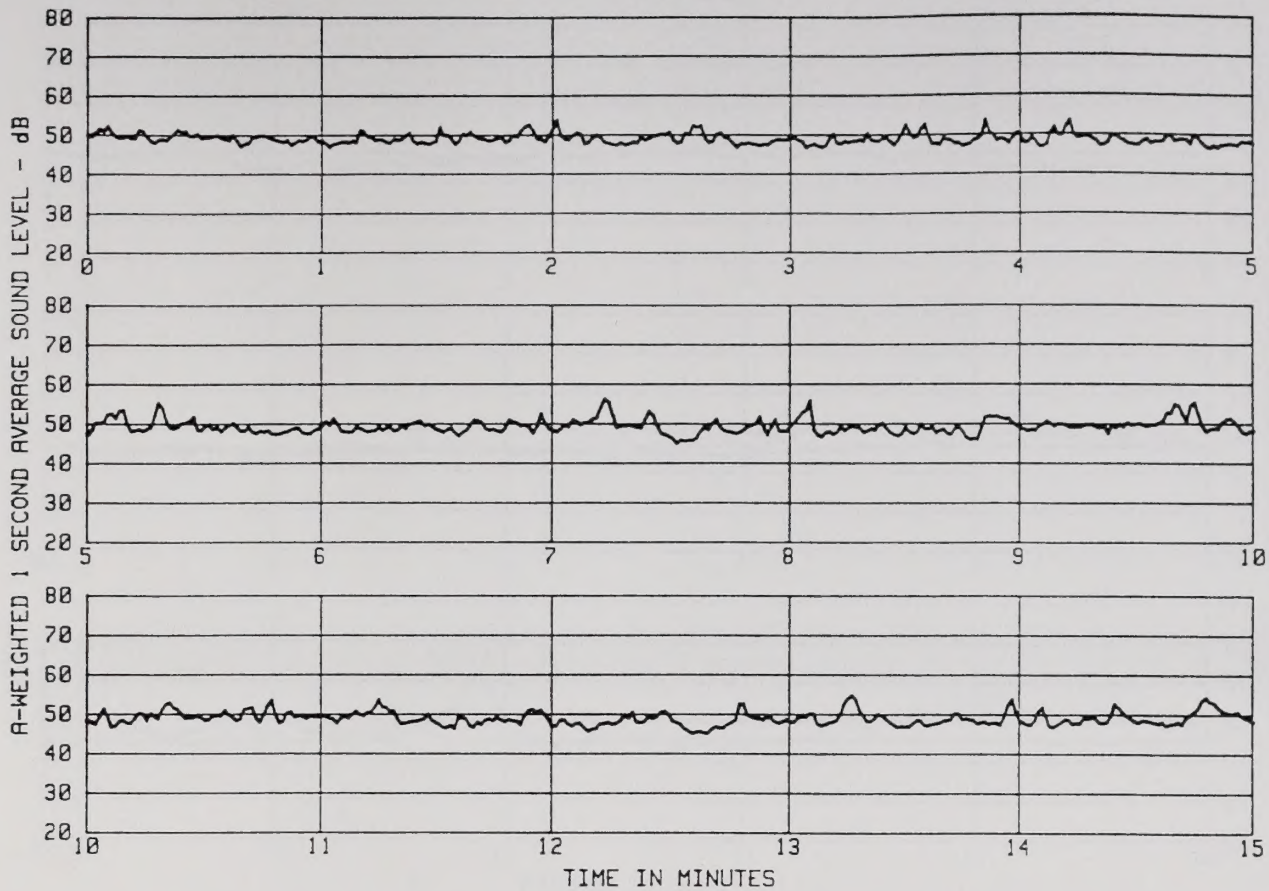
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



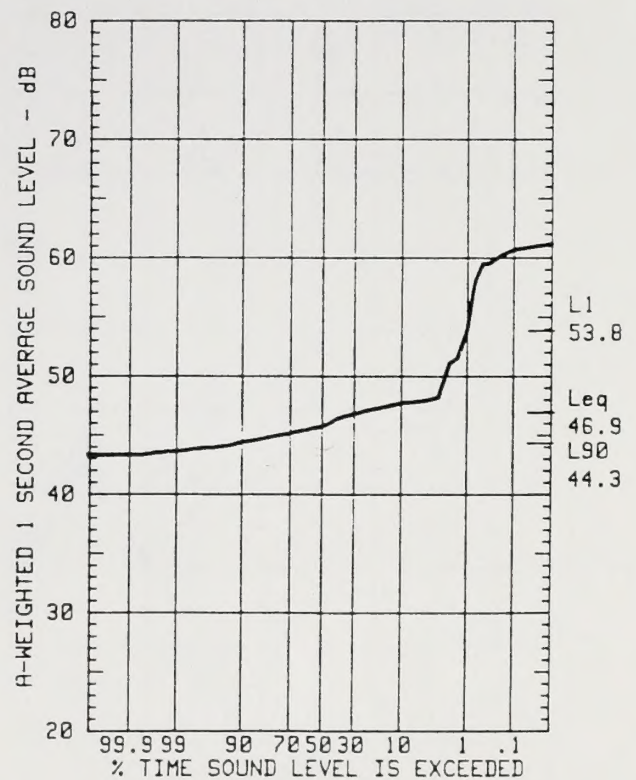
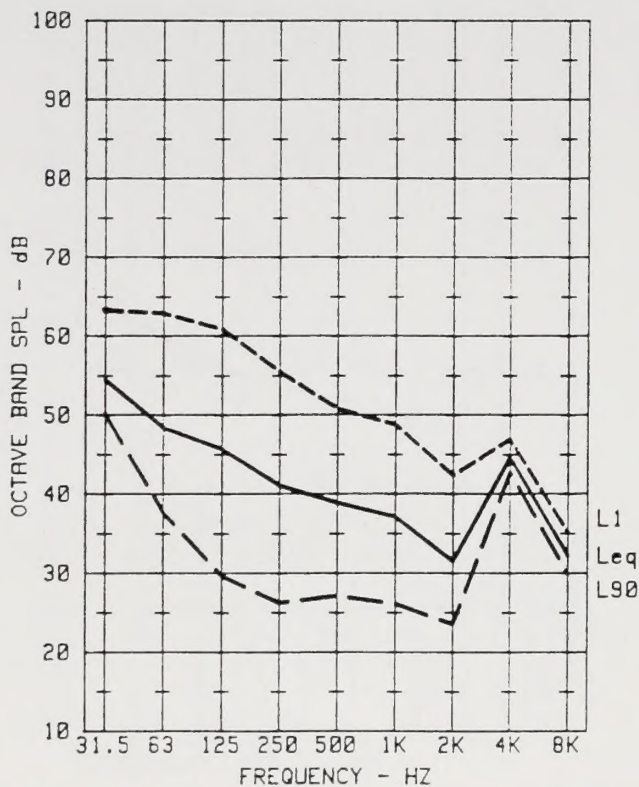
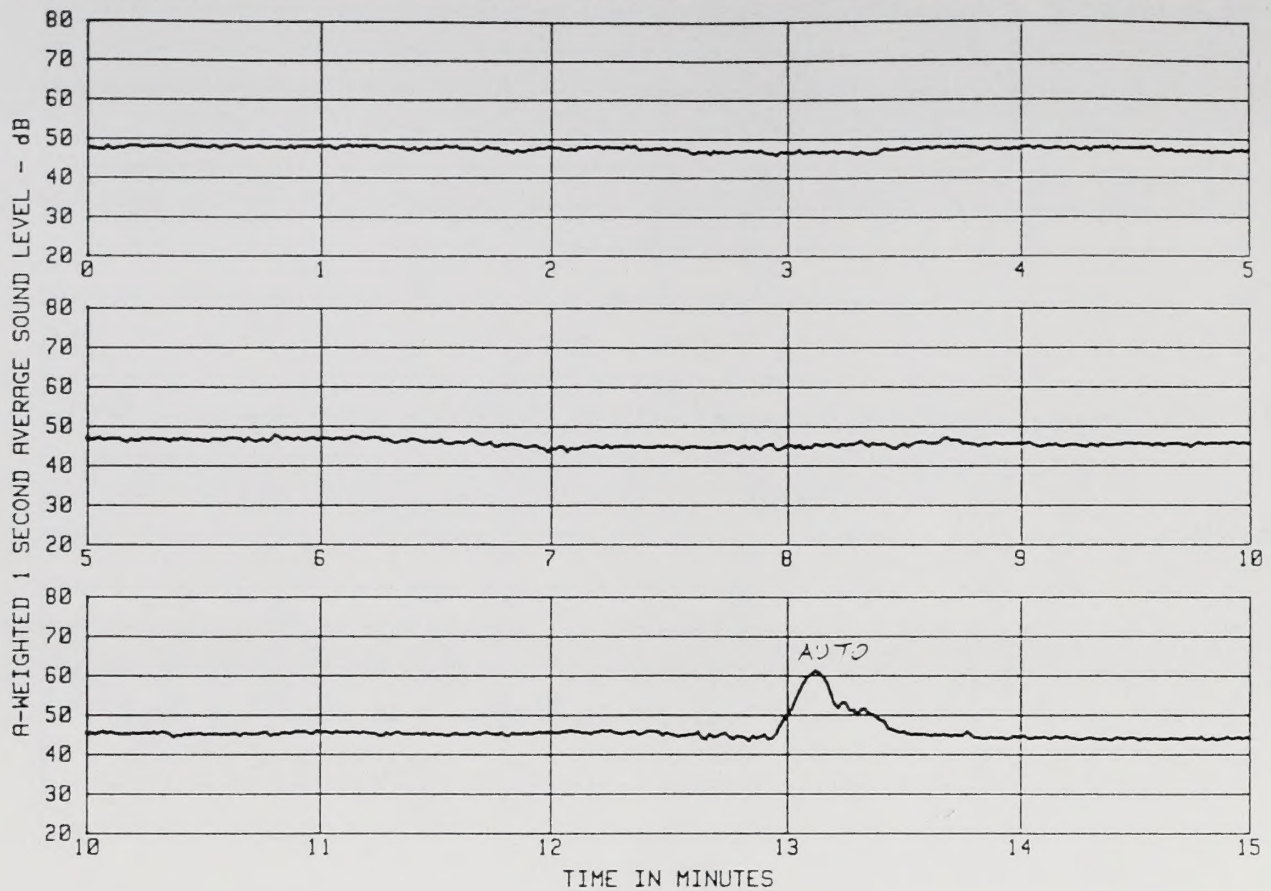
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 INTERSECTION OF OSDICK & OLD BUTTE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



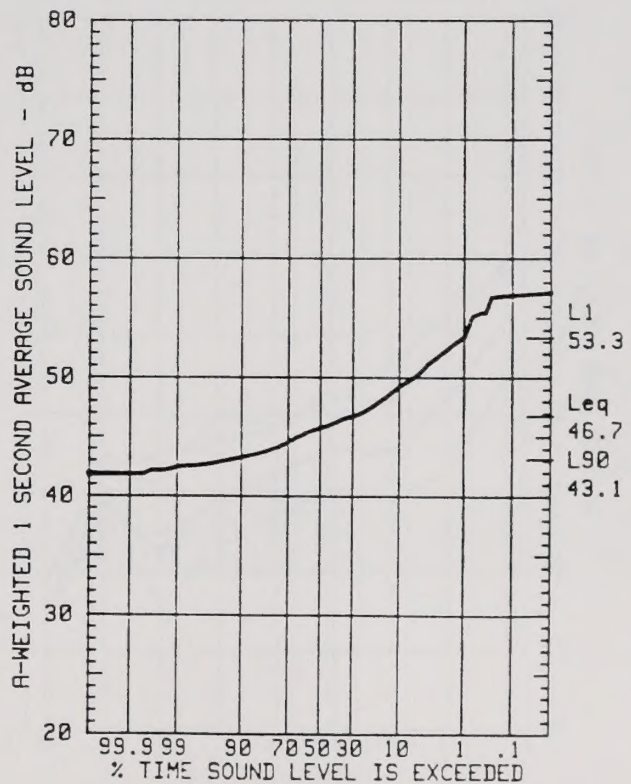
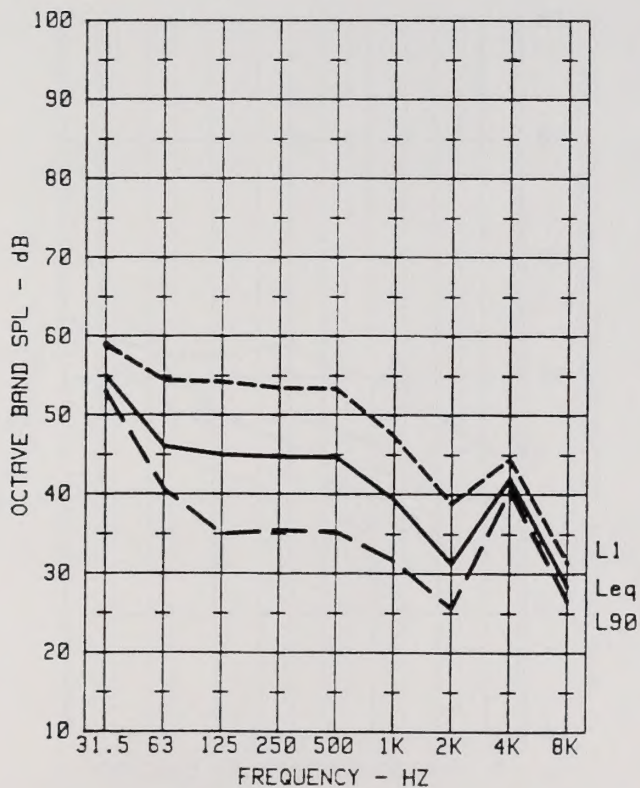
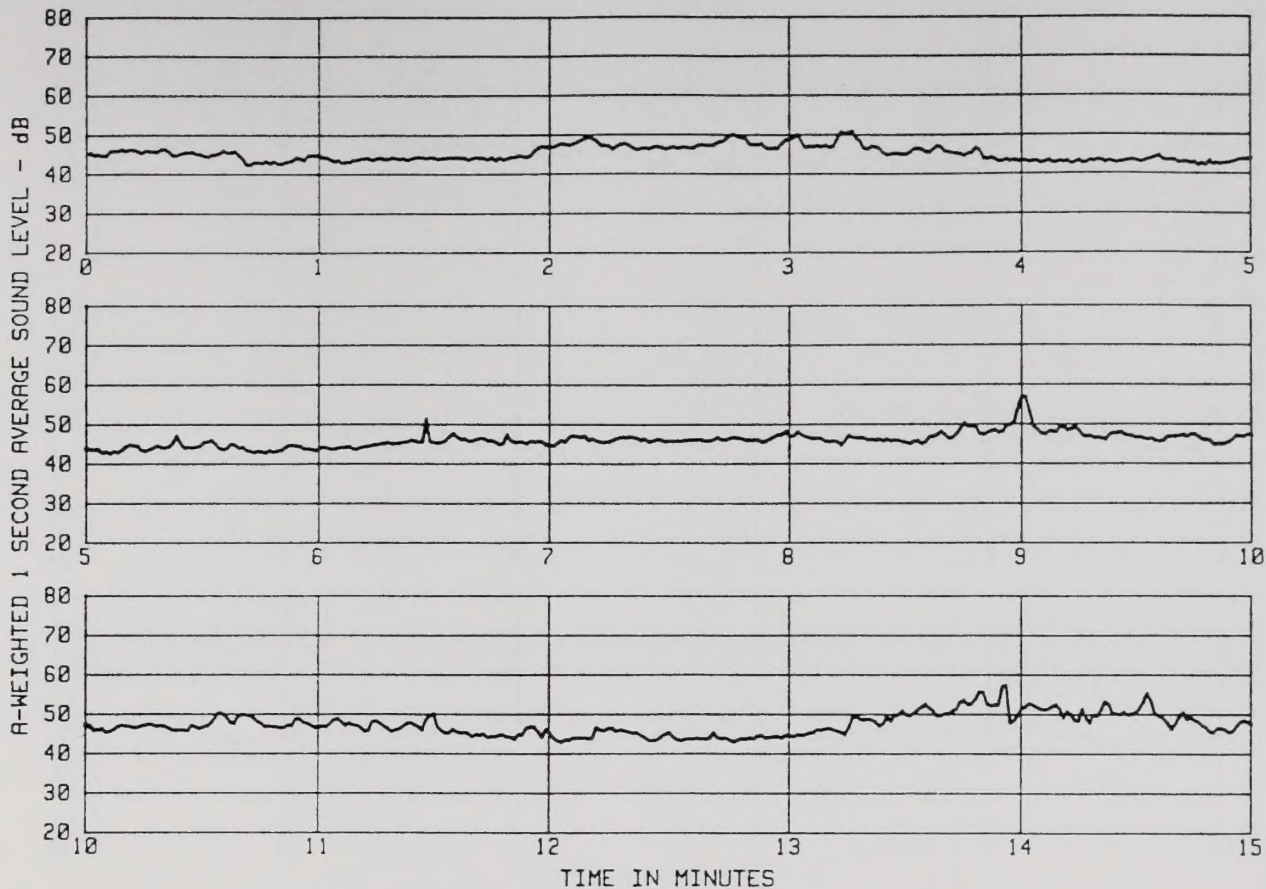
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 INTERSECTION OF OSDICK & OLD BUTTE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



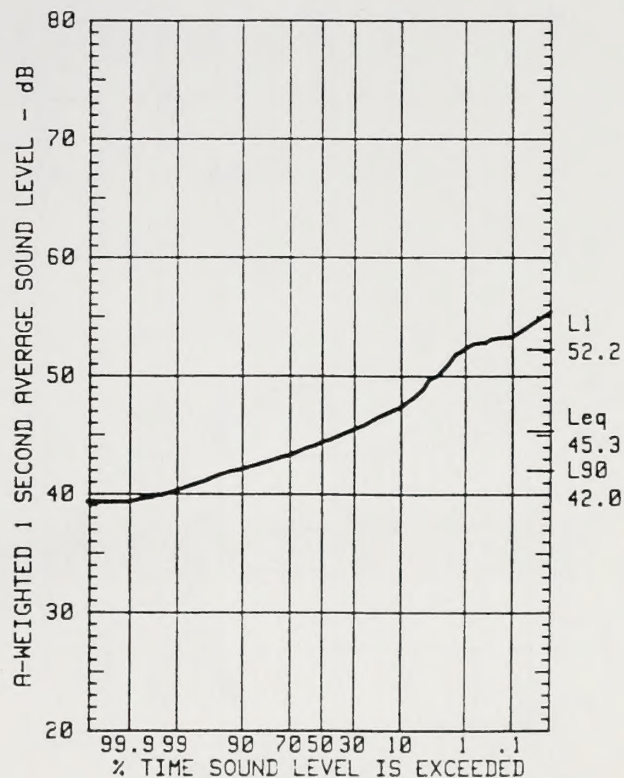
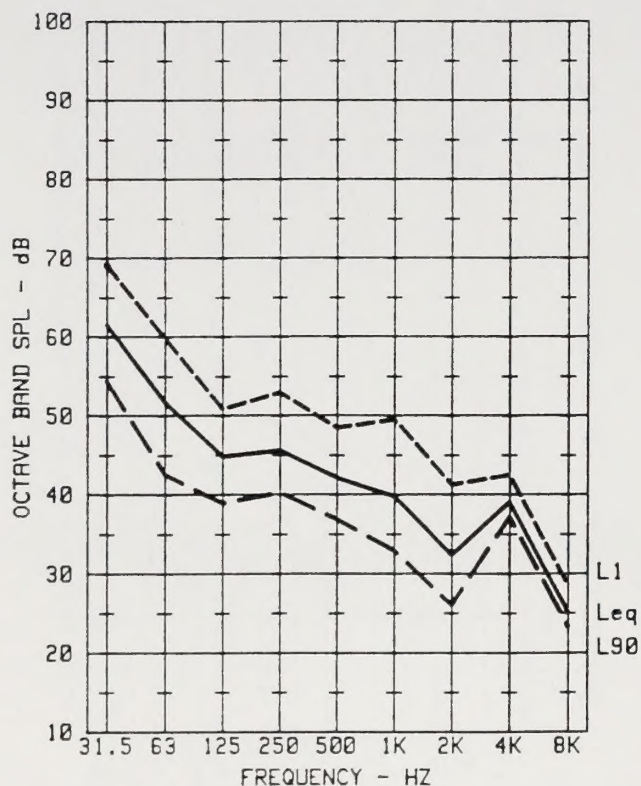
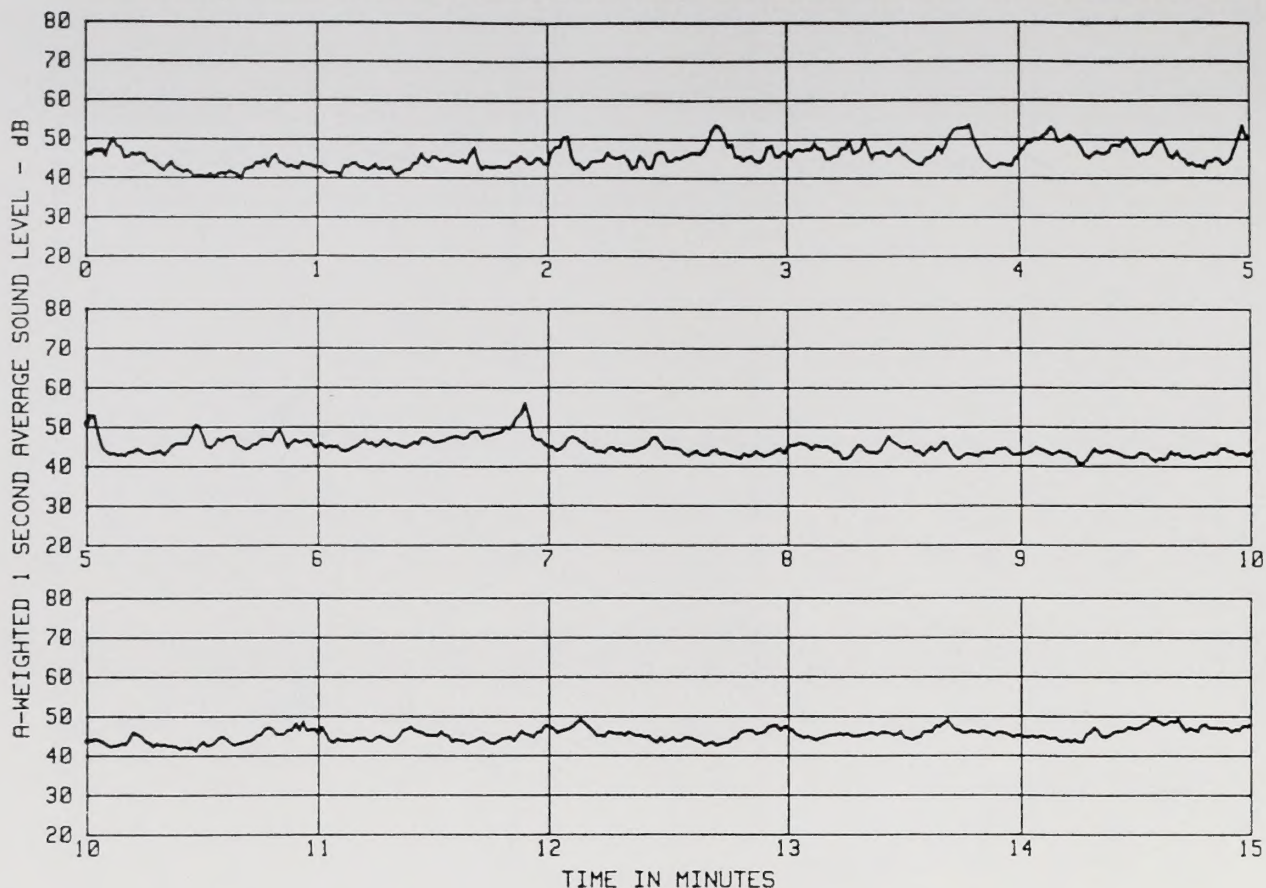
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 INTERSECTION OF OSDICK & OLD BUTTE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



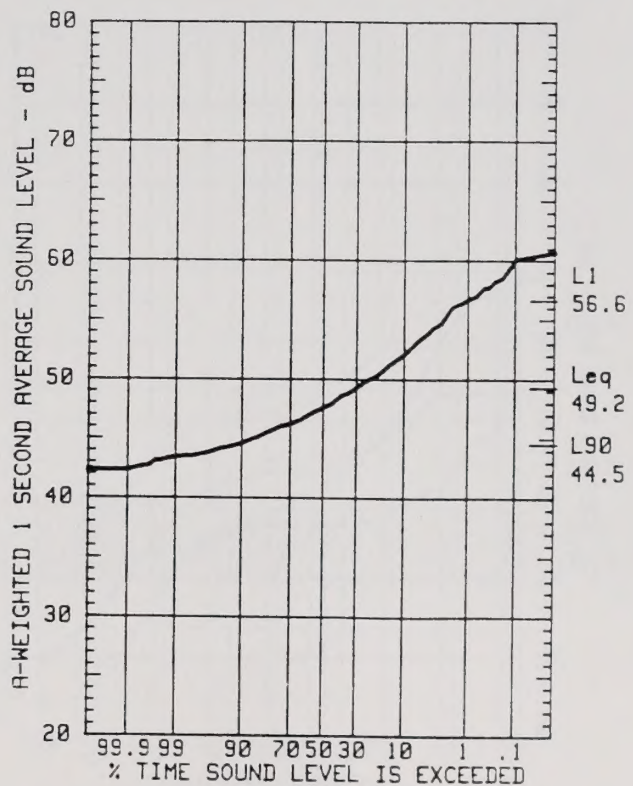
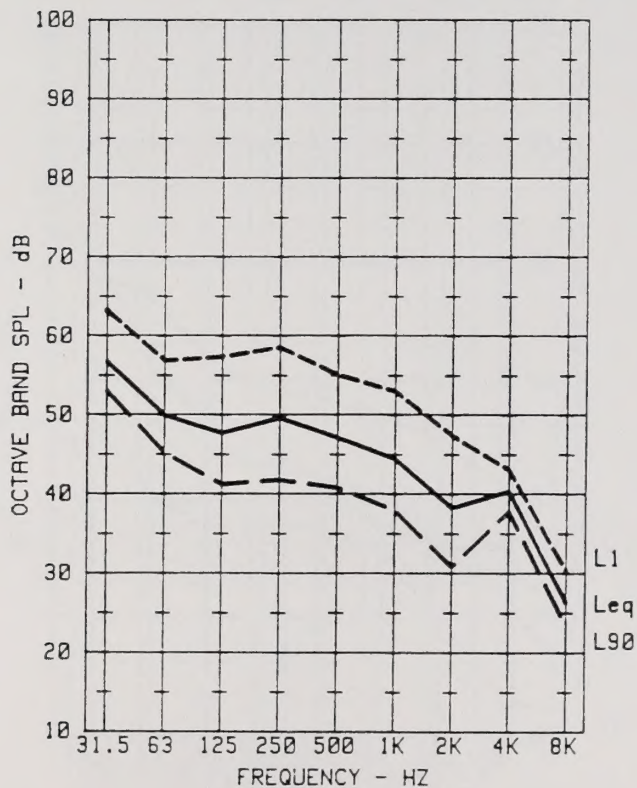
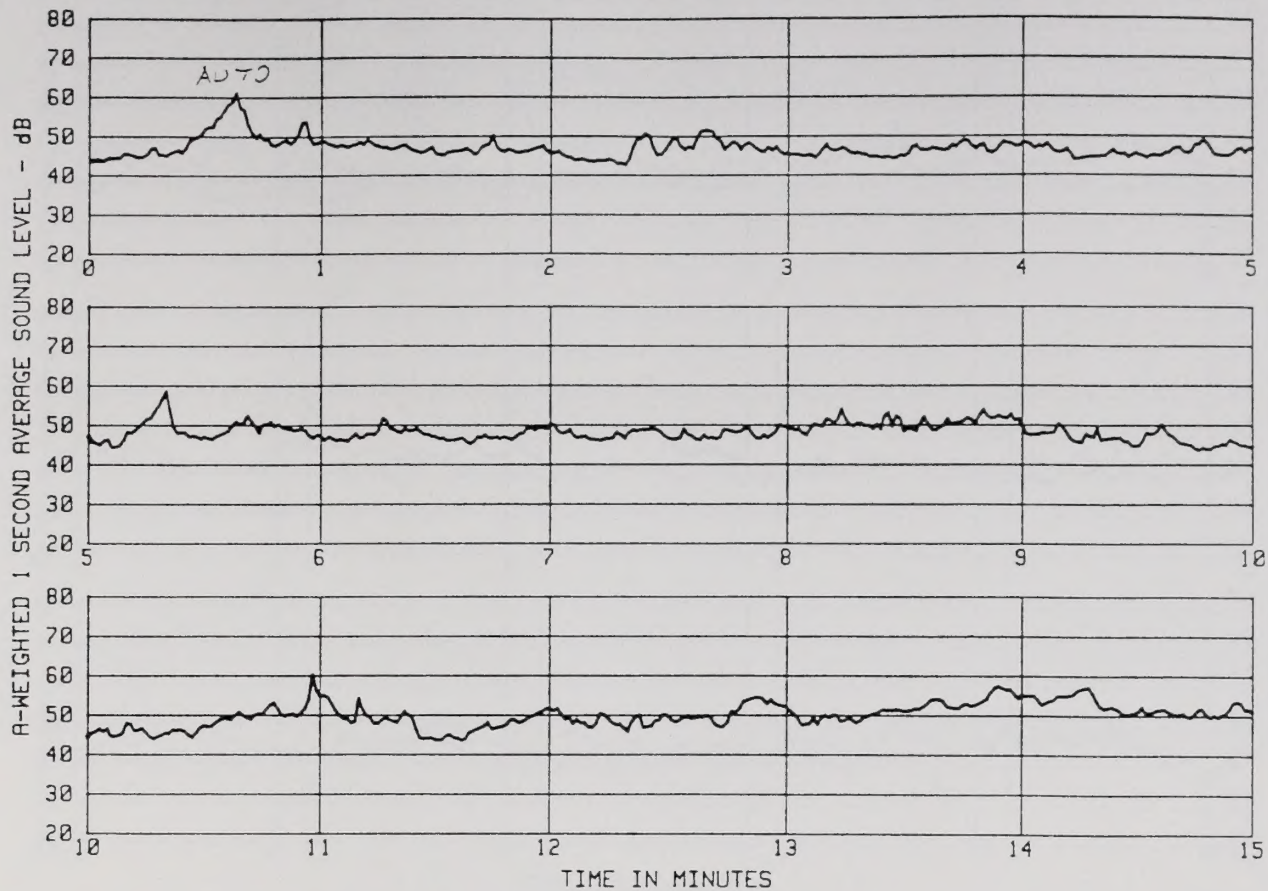
RAND MINING BALTIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 INTERSECTION OF OSDICK & OLD BUTTE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



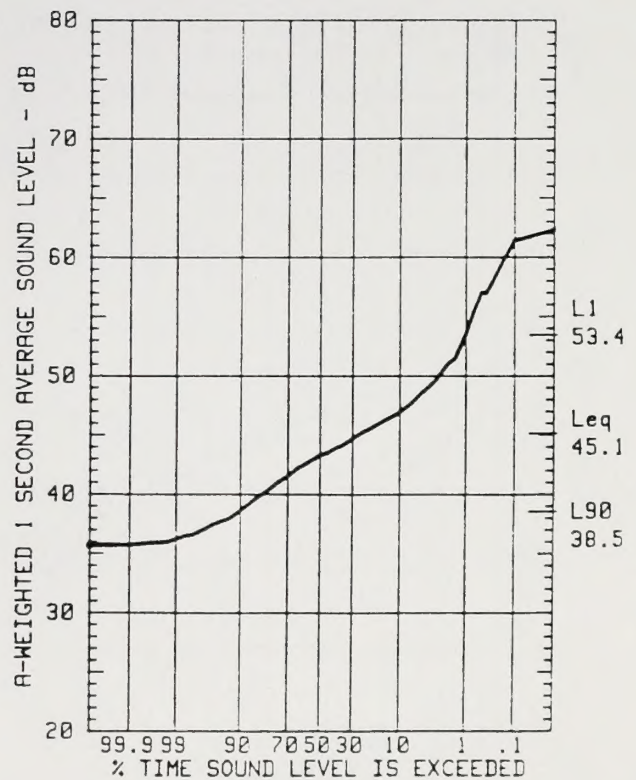
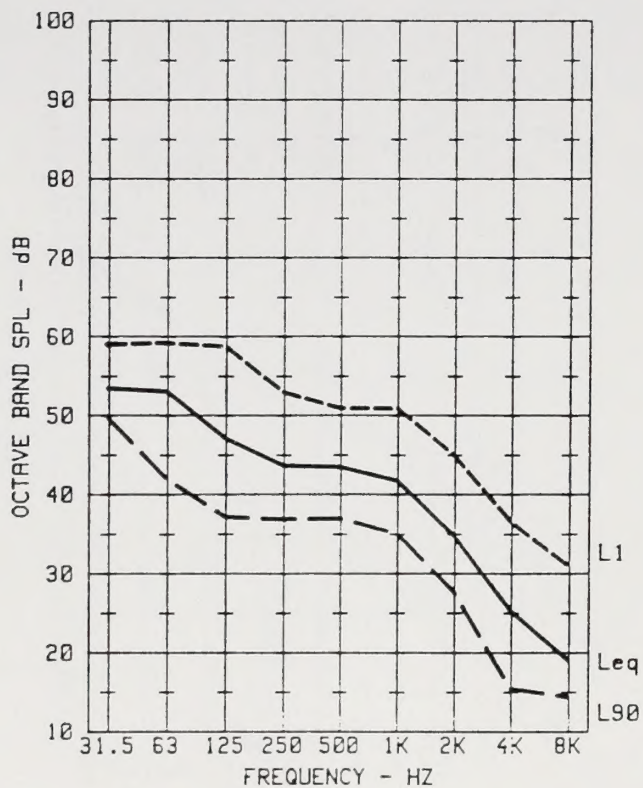
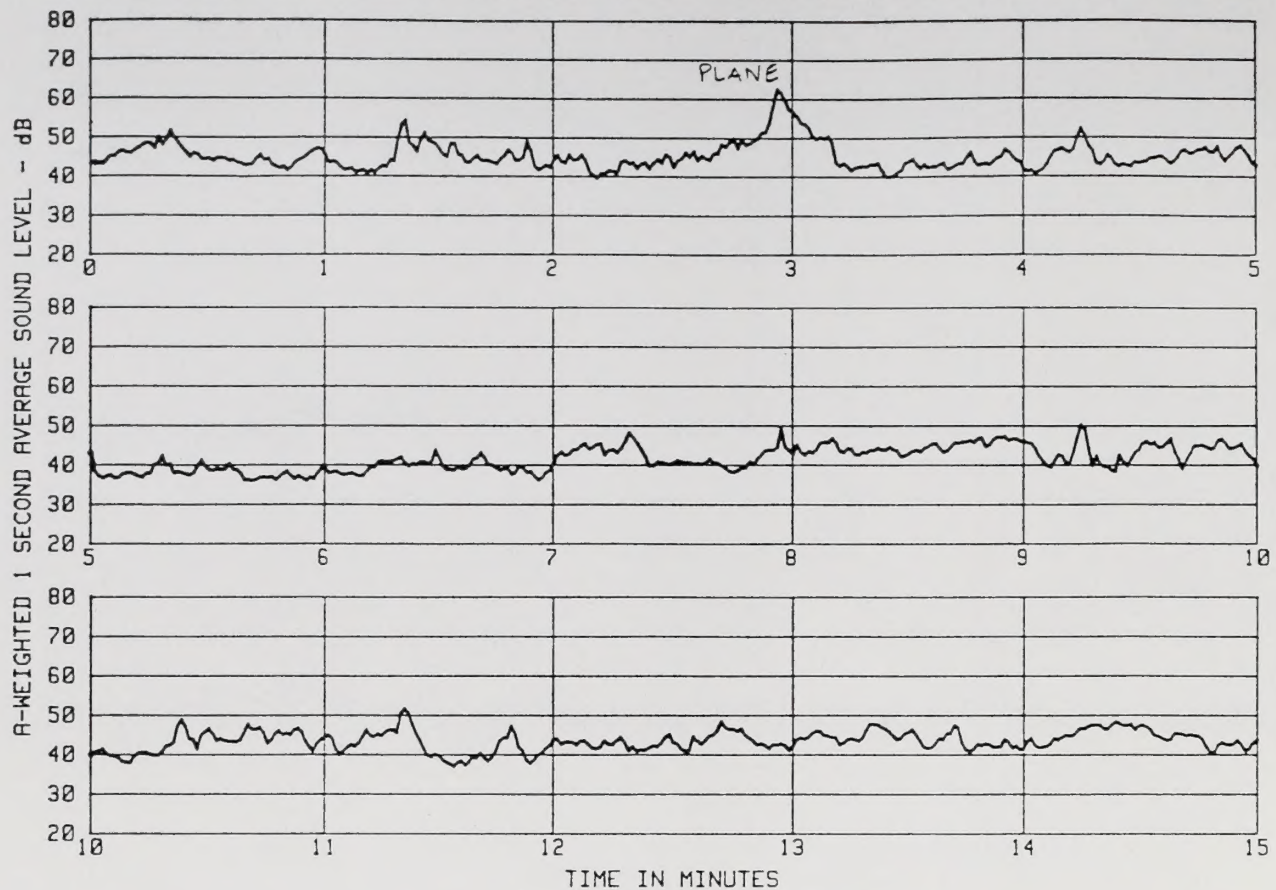
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



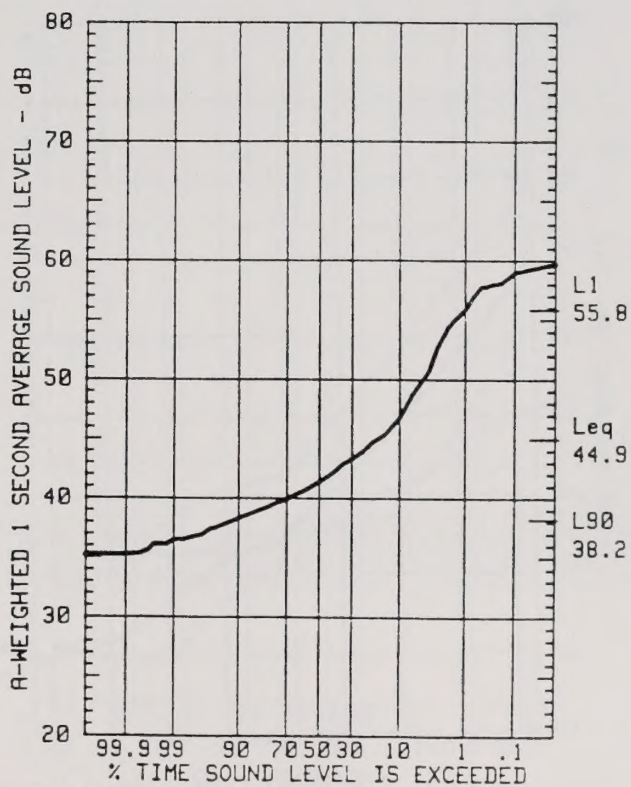
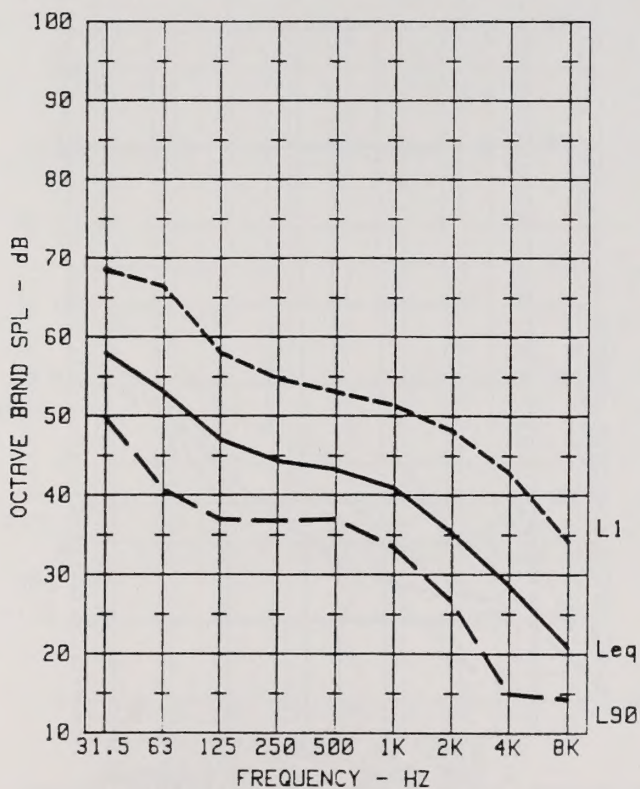
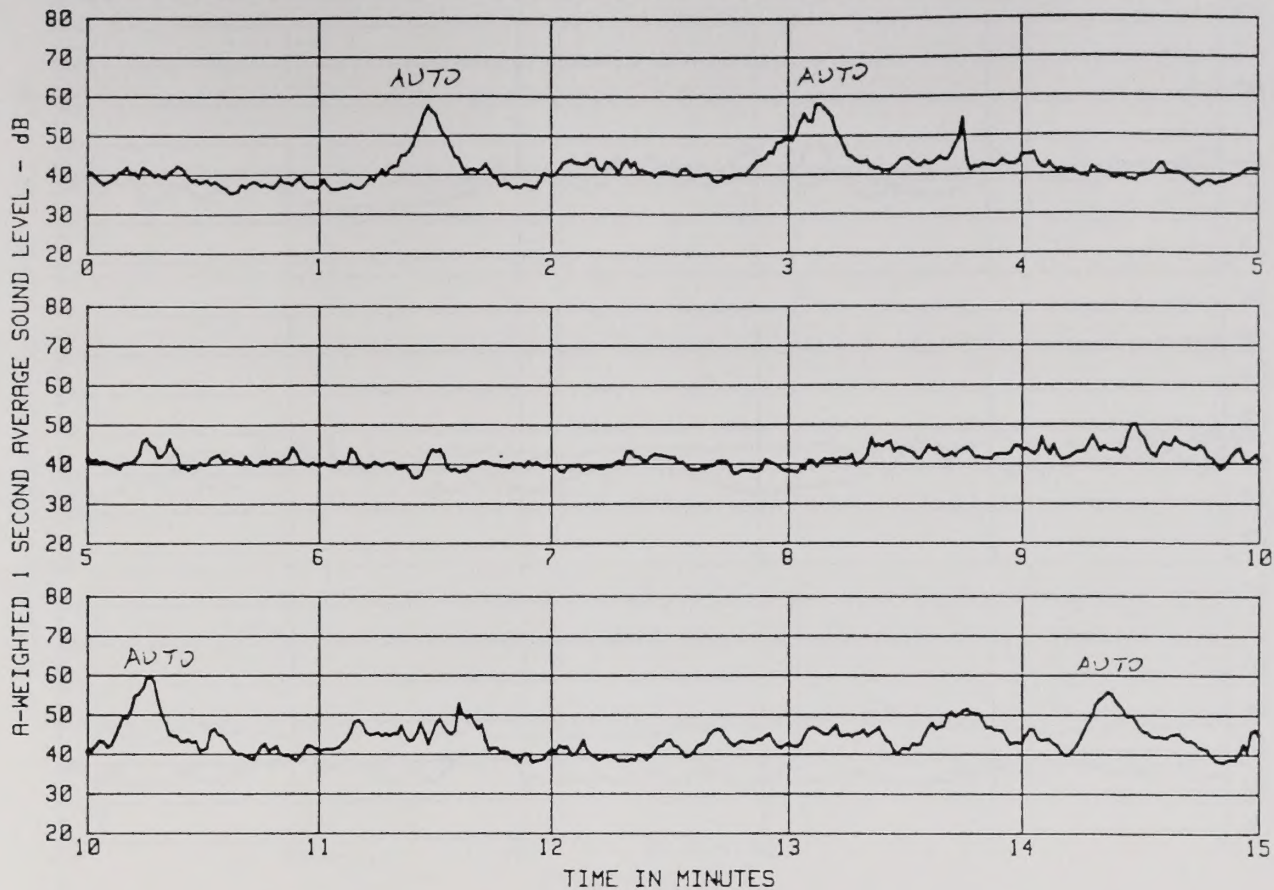
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 INTERSECTION OF OSDICK & OLD BUTTE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



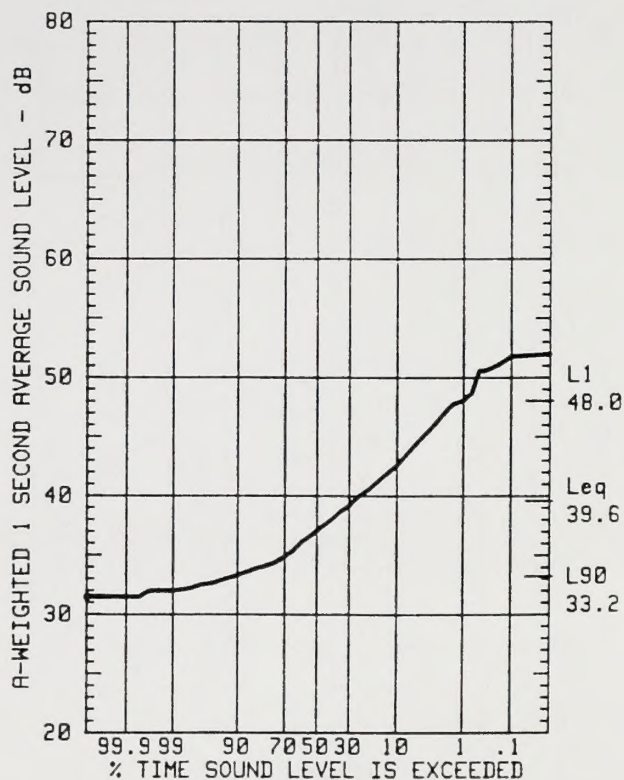
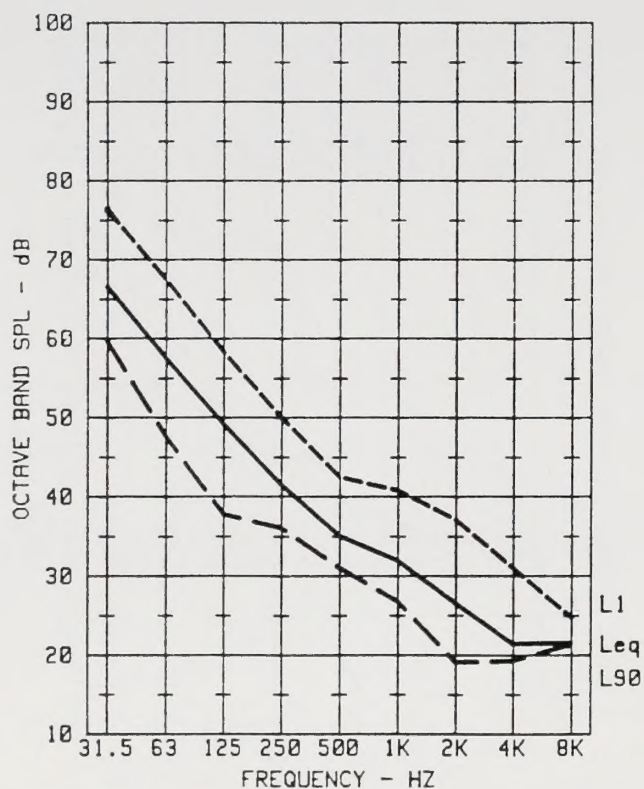
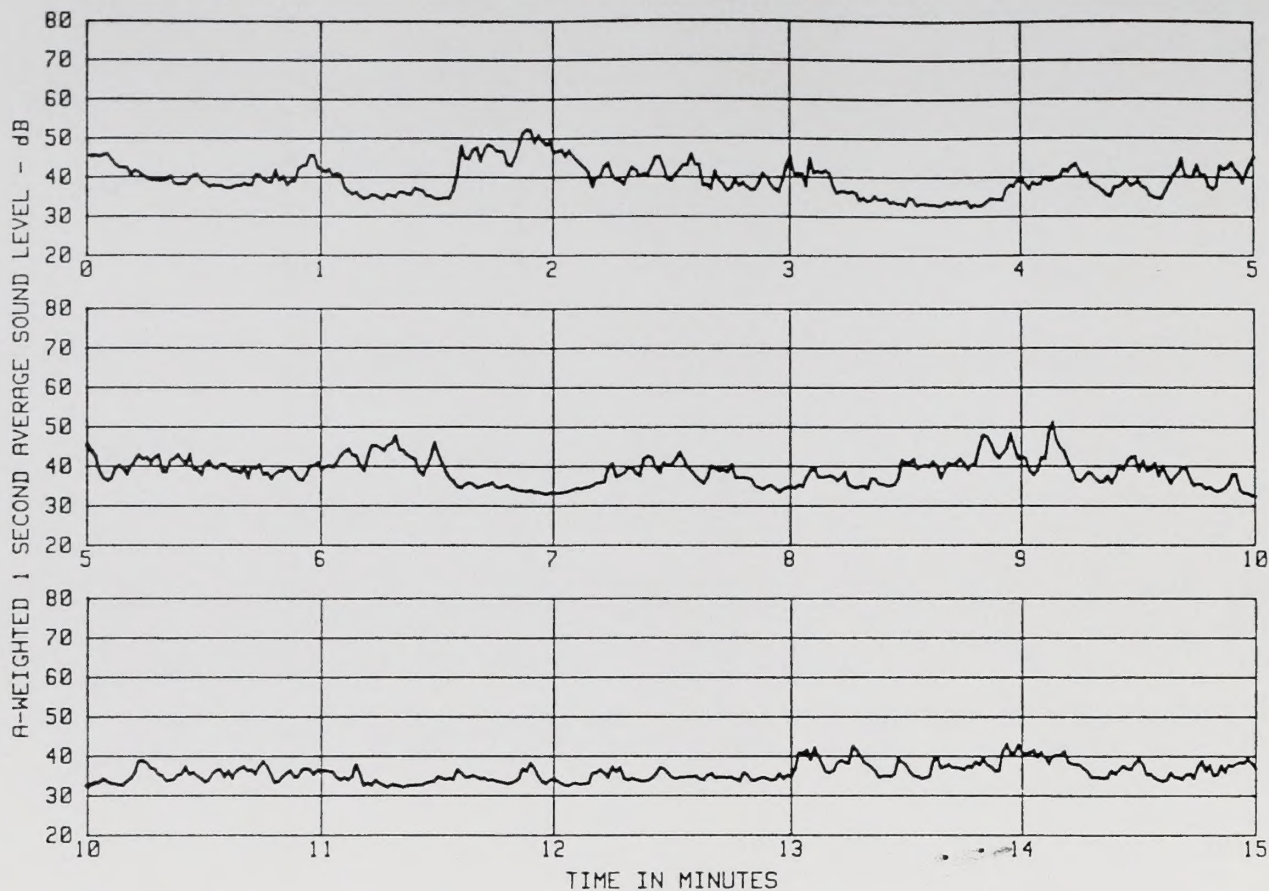
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 INTERSECTION OF OSDICK & OLD BUTTE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



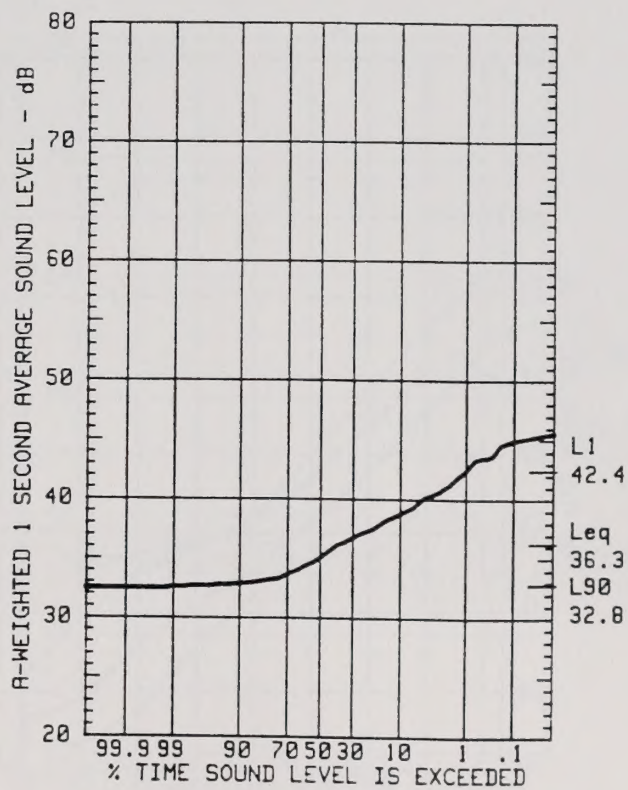
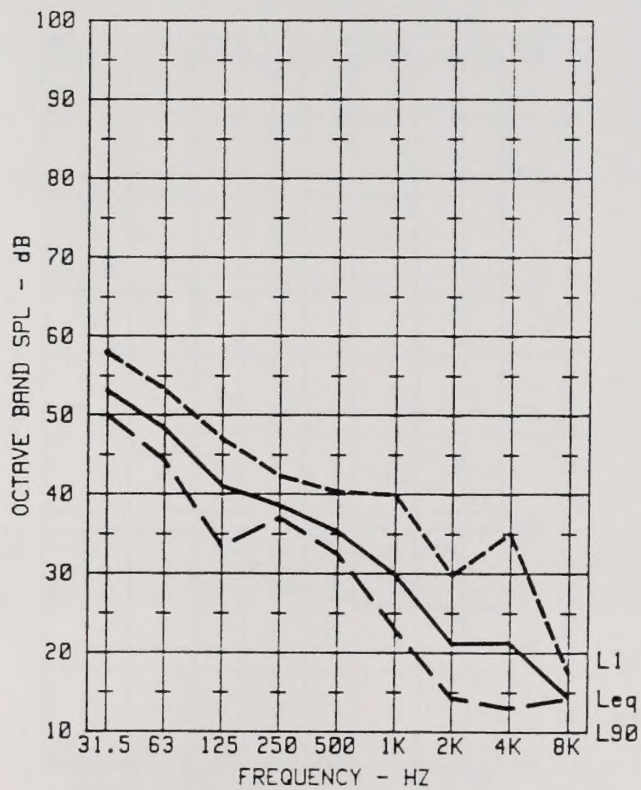
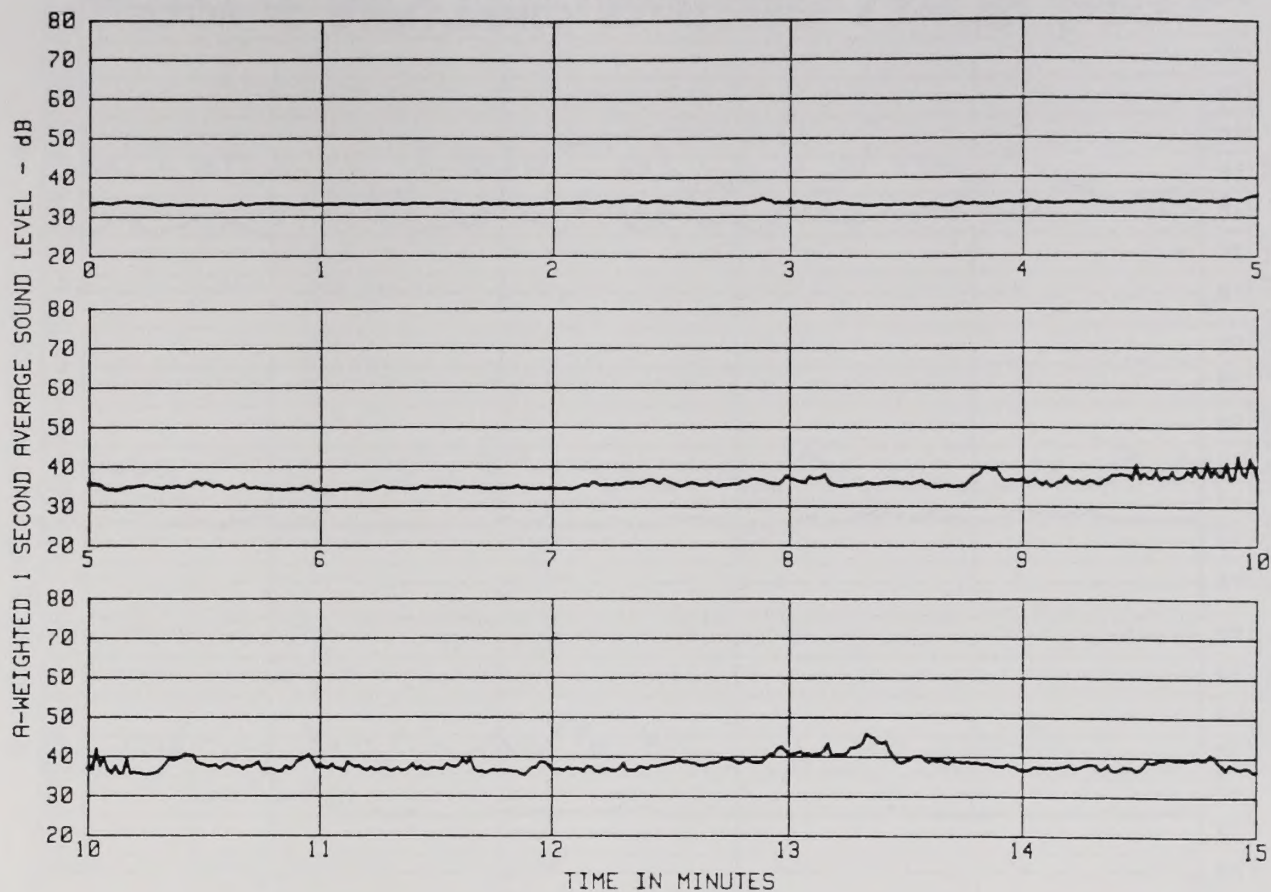
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 INTERSECTION OF OSDICK & OLD BUTTE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



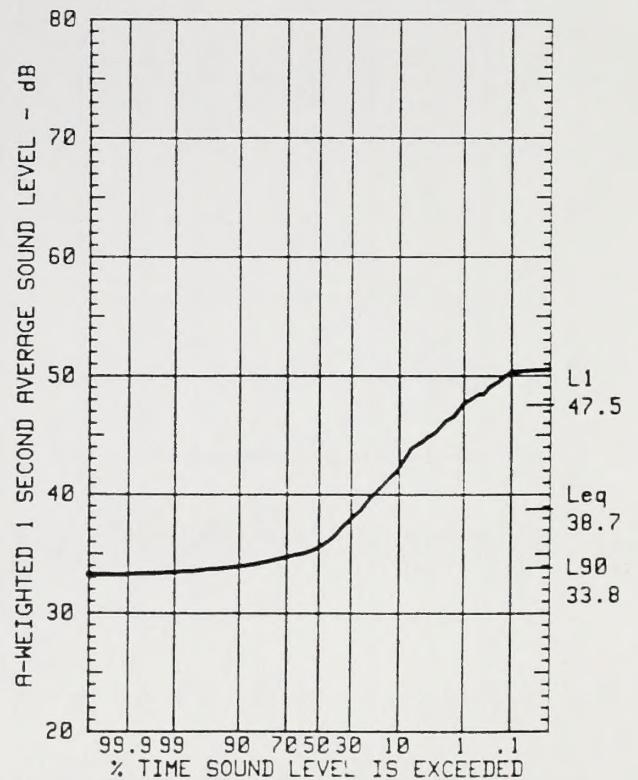
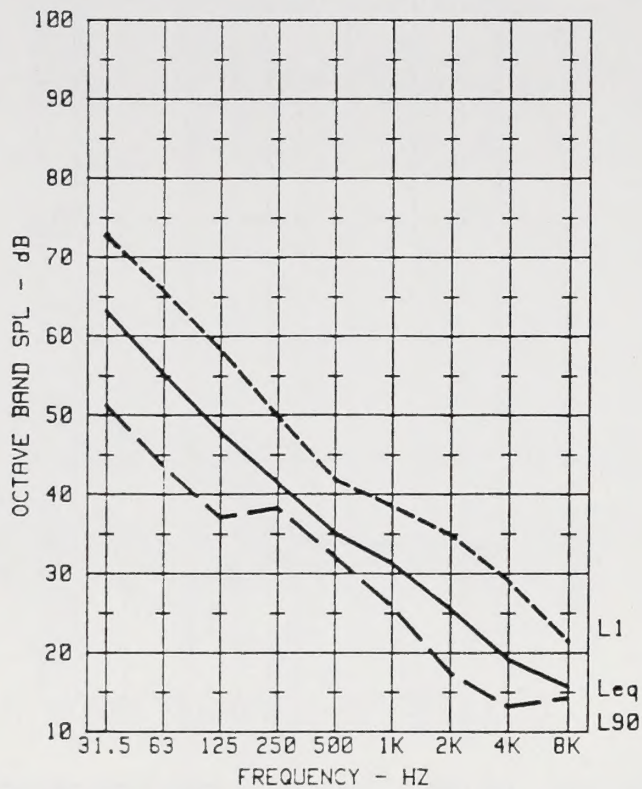
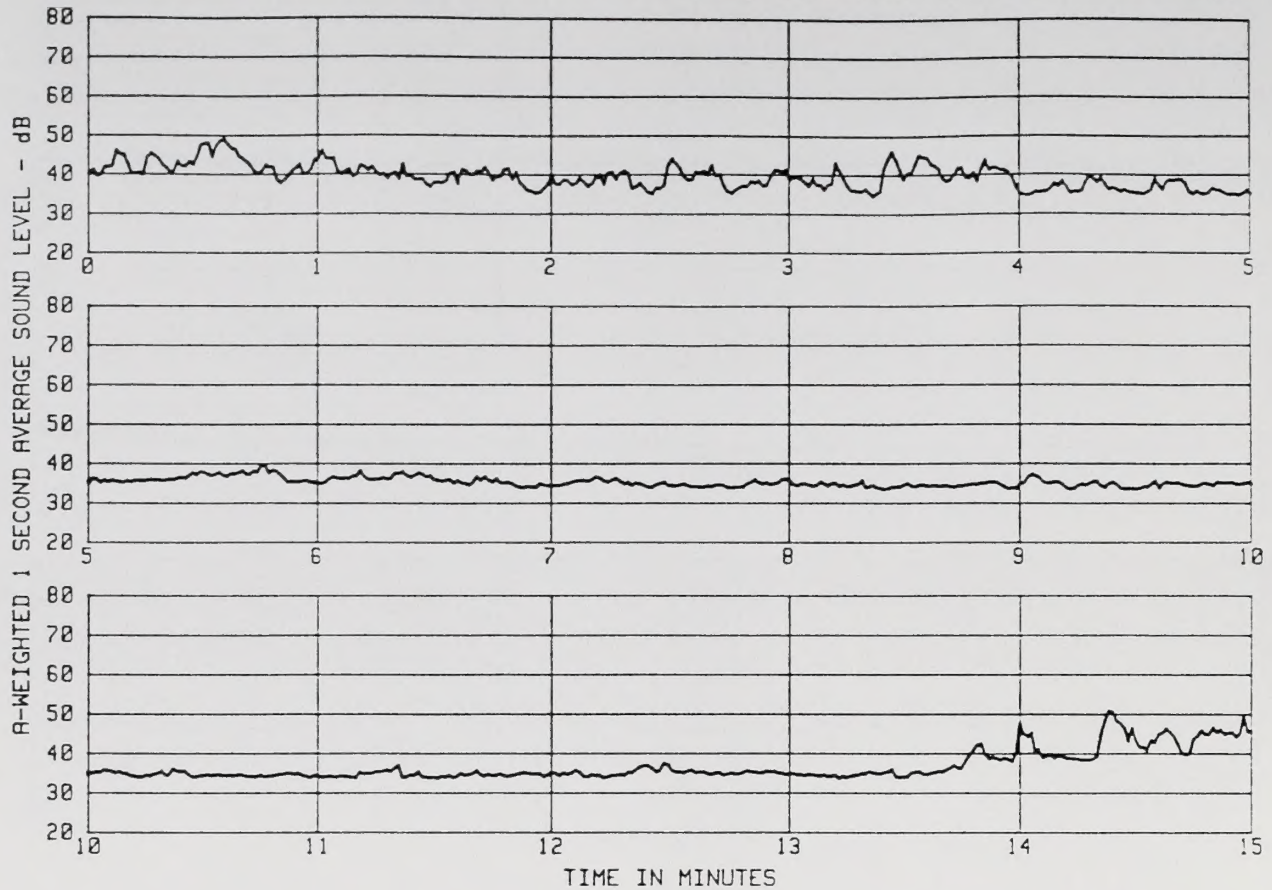
RAND MINING BAL TIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 NORTHERLY END OF OLD BUTTE AT FENCE LINE
 05-24-1994 15:48-16:03

WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



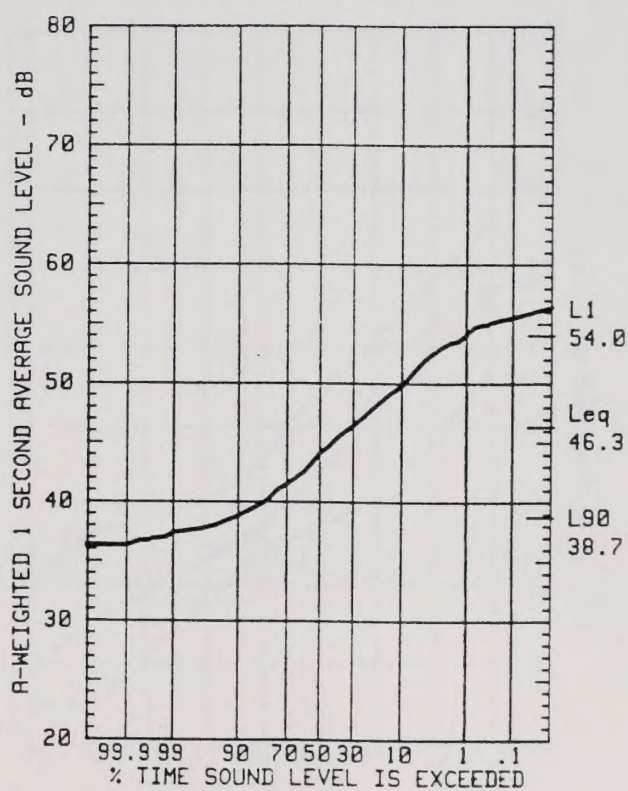
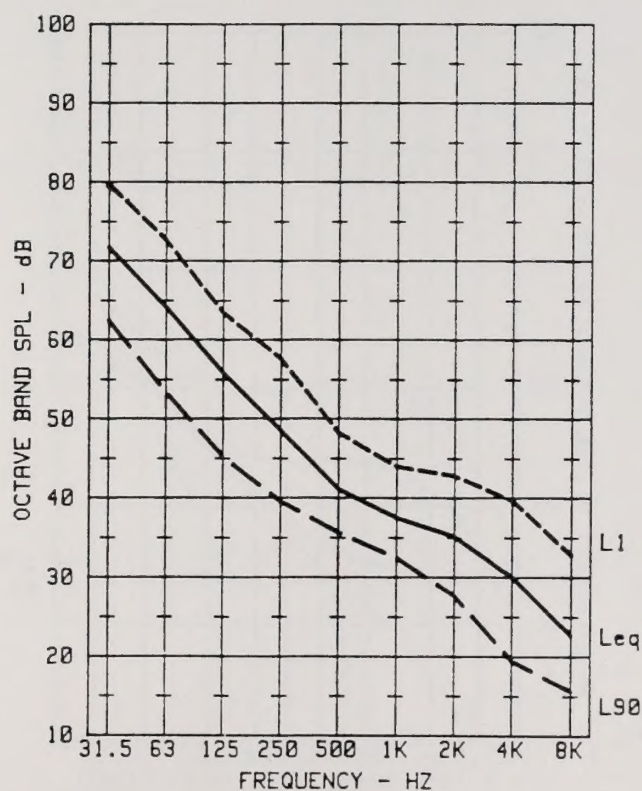
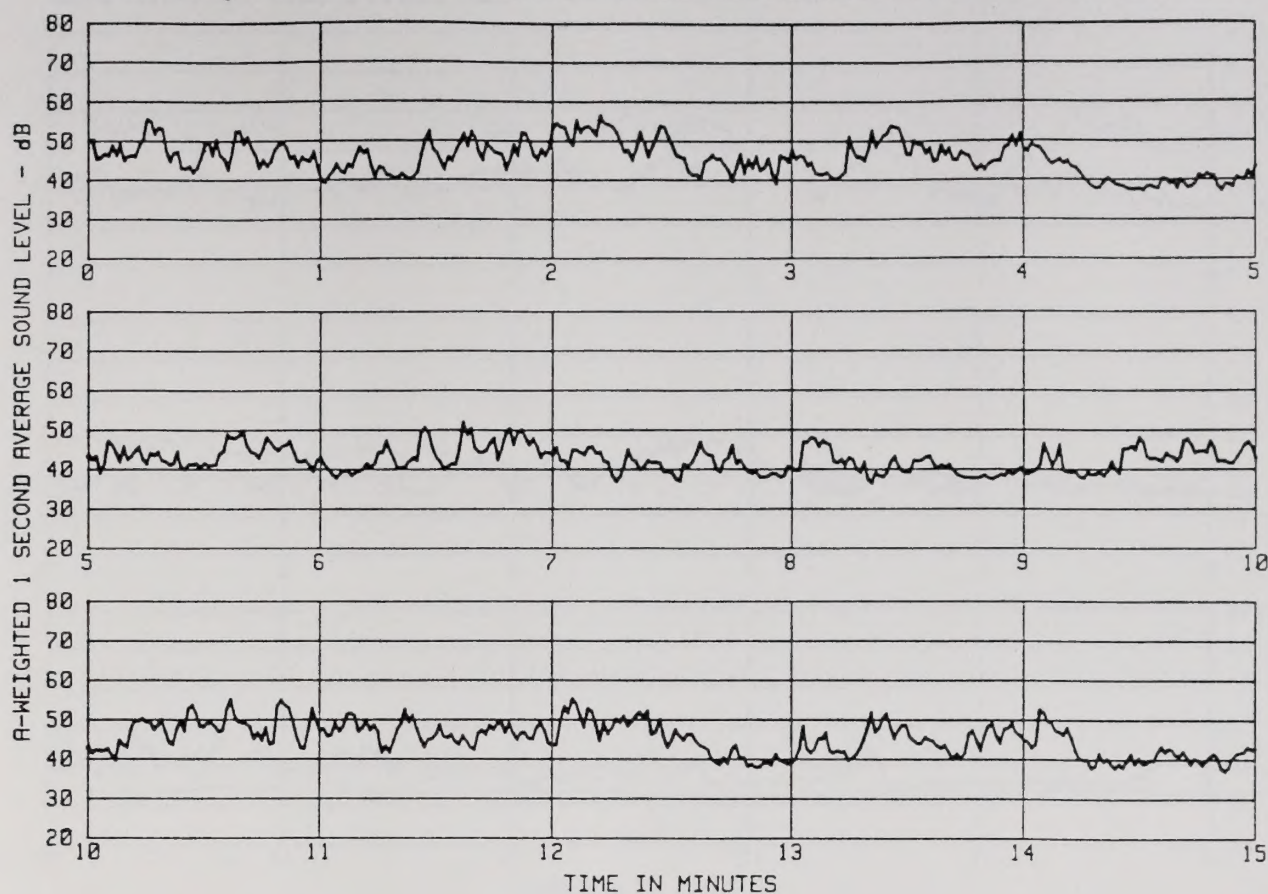
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 NORTHERLY END OF OLD BUTTE AT FENCE LINE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



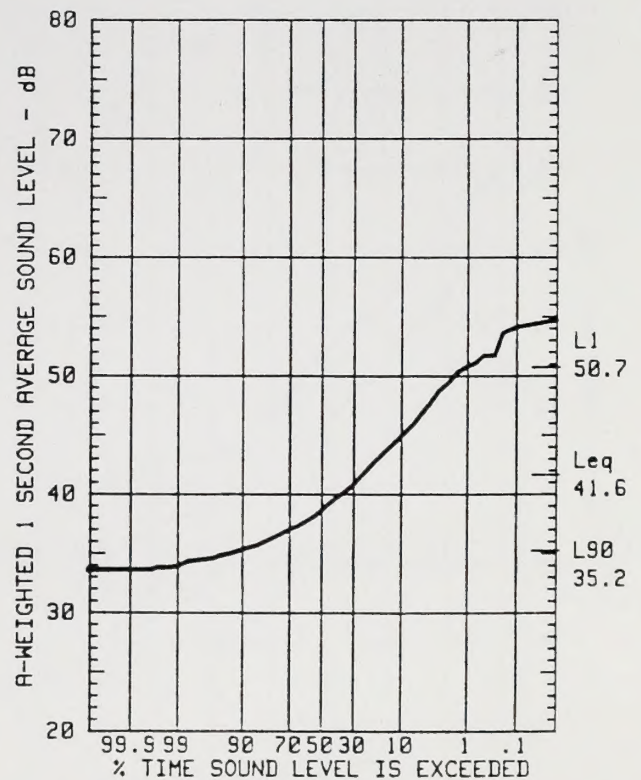
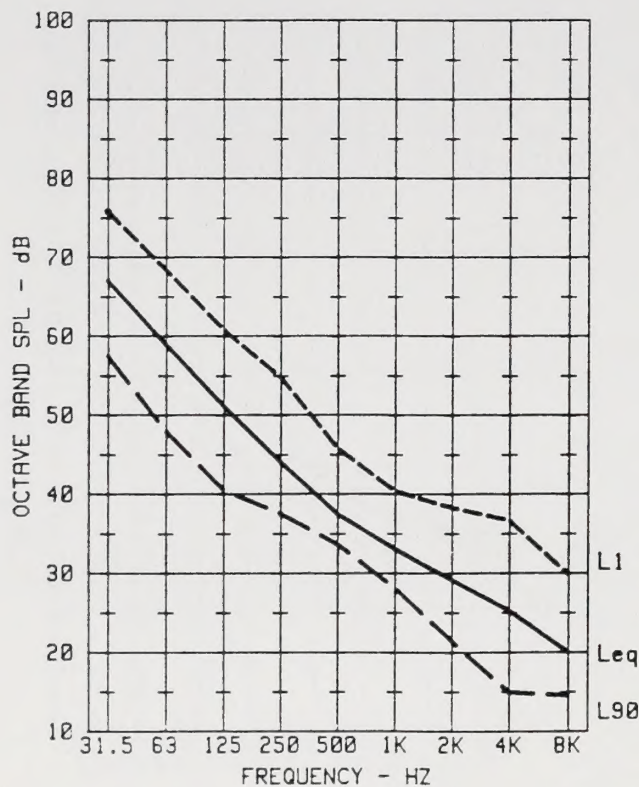
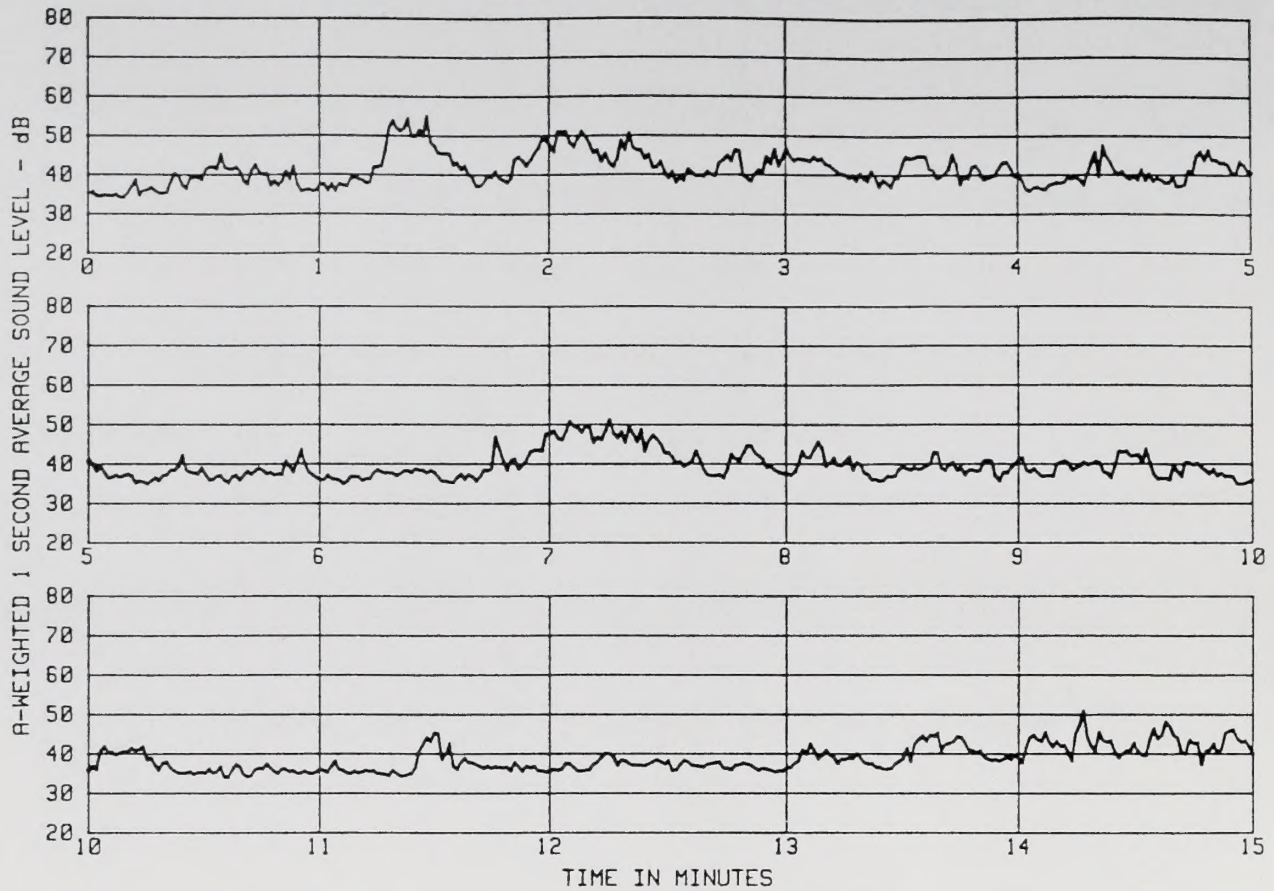
RAND MINING BALTIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 NORTHERLY END OF OLD BUTTE AT FENCE LINE
 05-24-1994 19:04-19:19

WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



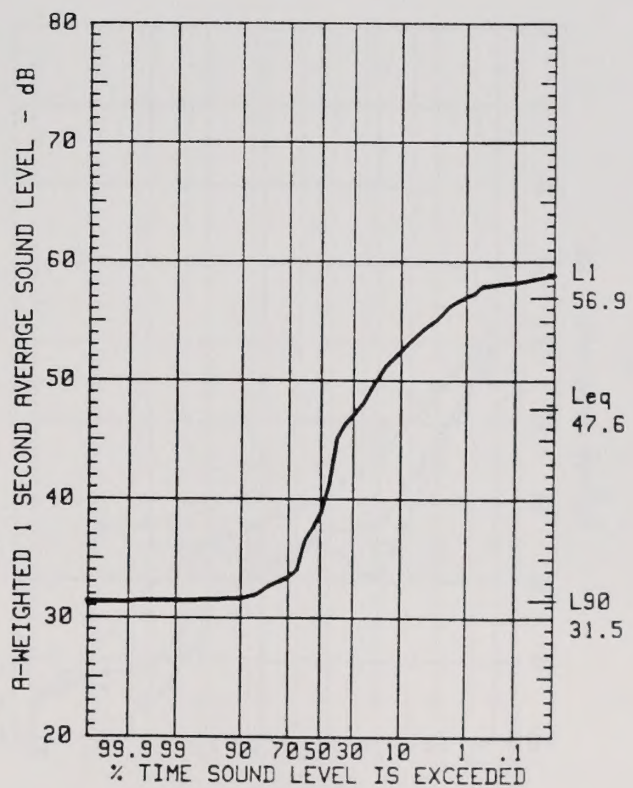
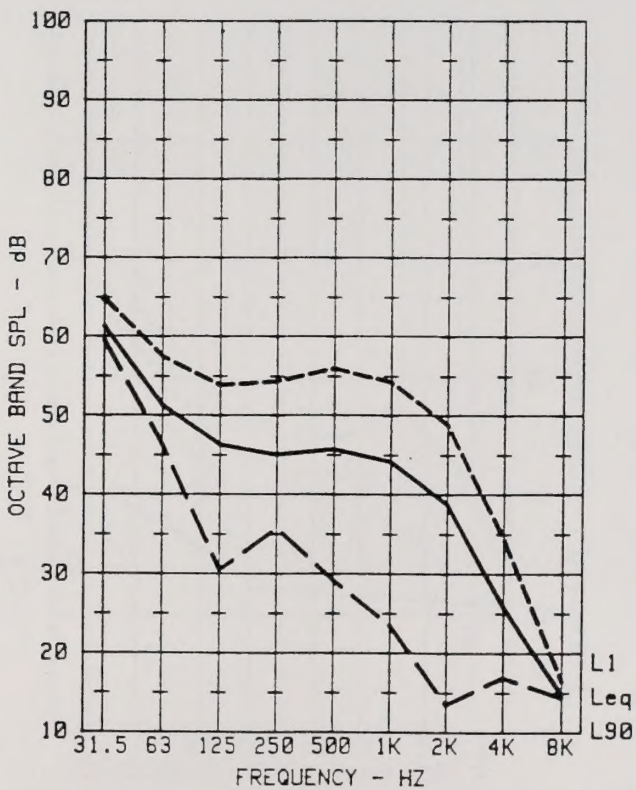
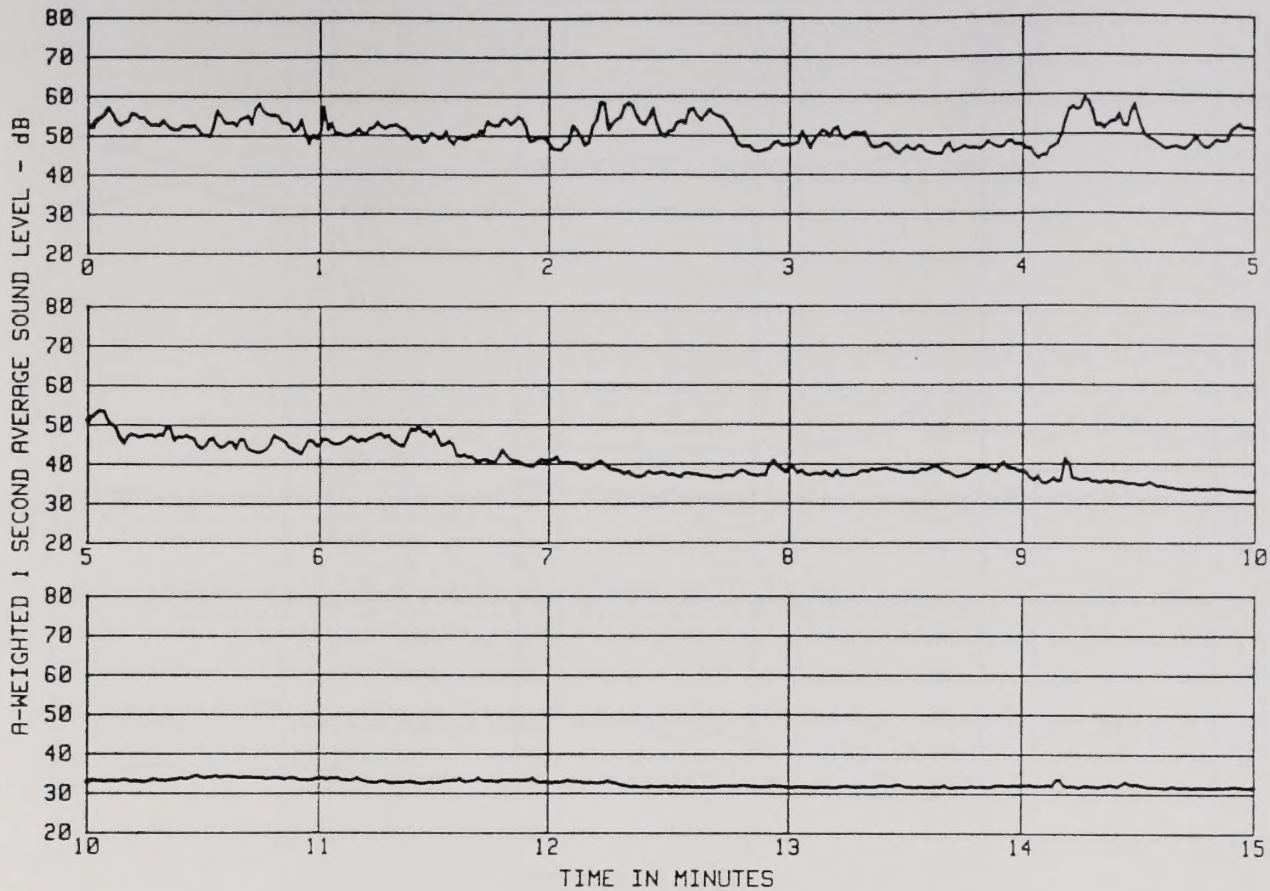
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 NORTHERLY END OF OLD BUTTE AT FENCE LINE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



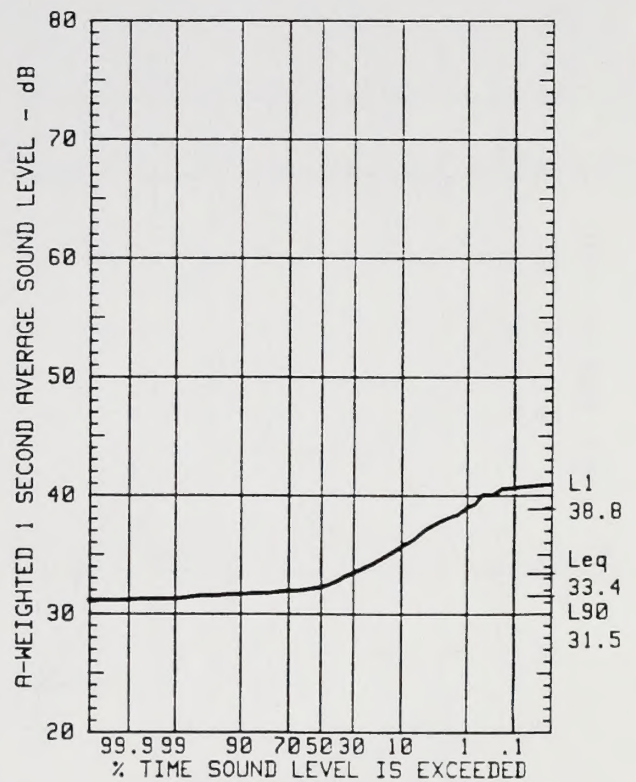
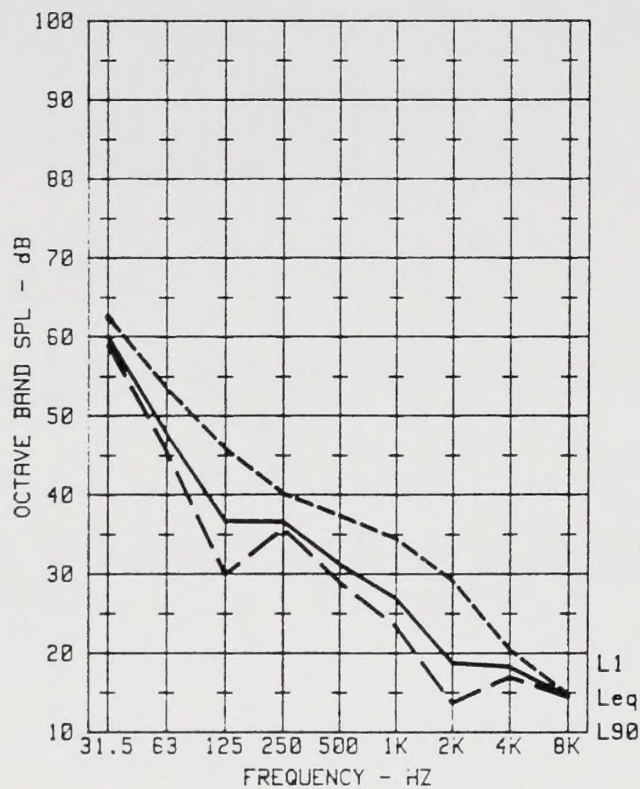
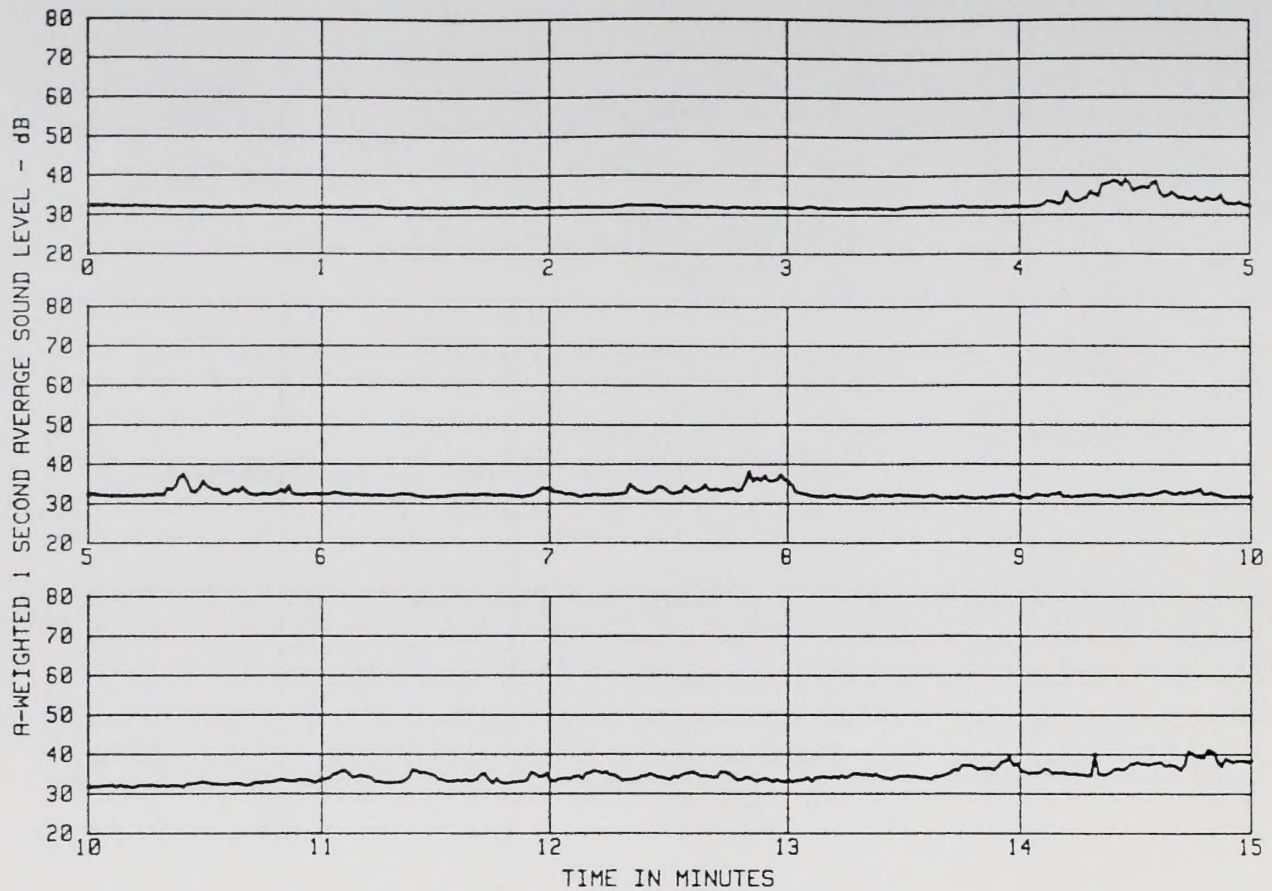
RAND MINING BALTIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 NORTHERLY END OF OLD BUTTE AT FENCE LINE
 05-24-1994 19:40-19:55

WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



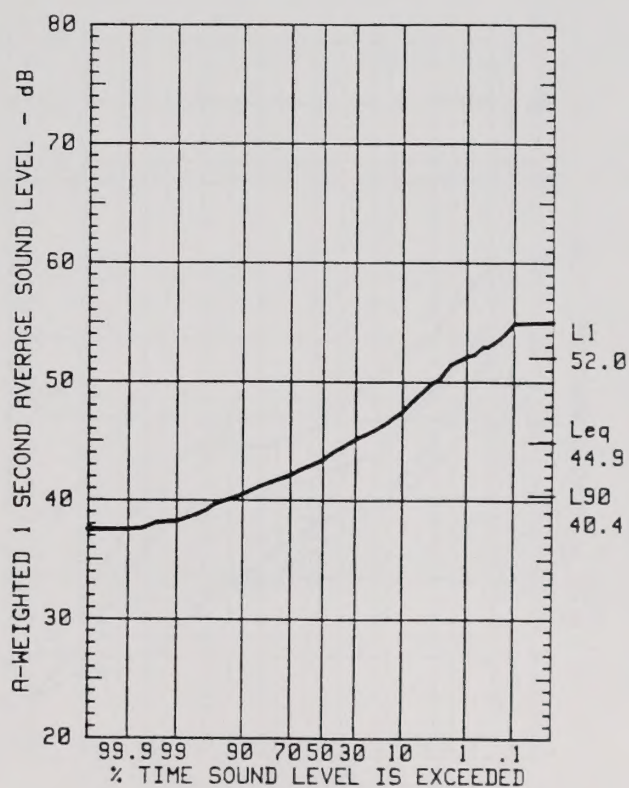
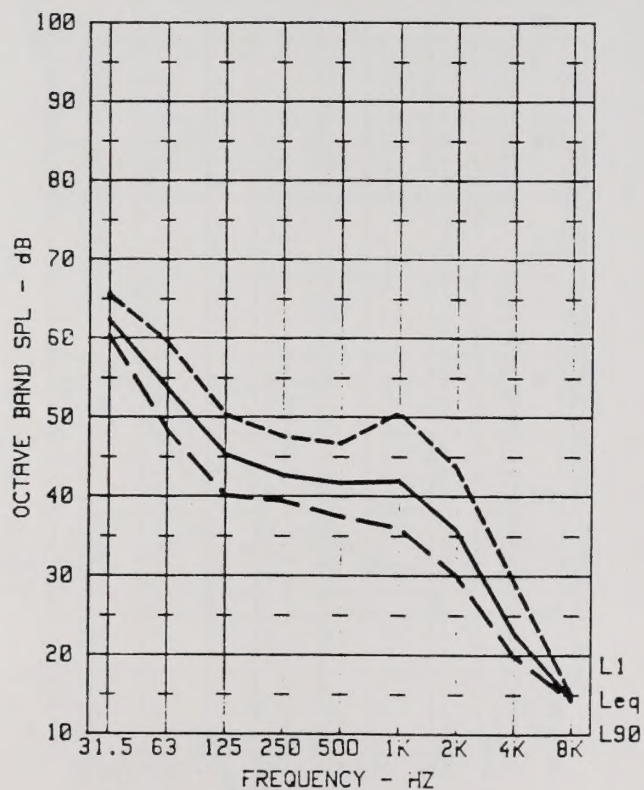
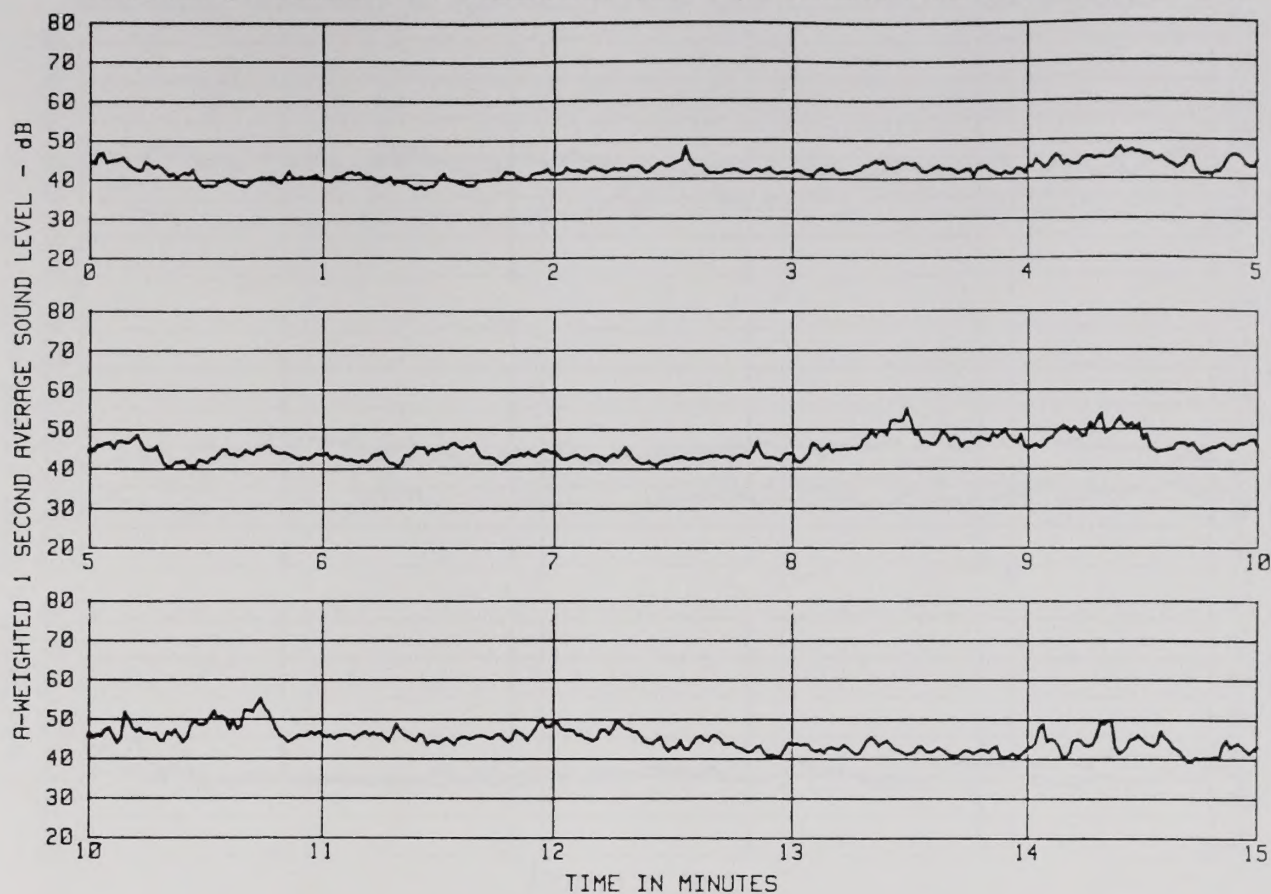
RAND MINING BALTIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 NORTHERLY END OF OLD BUTTE AT FENCE LINE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



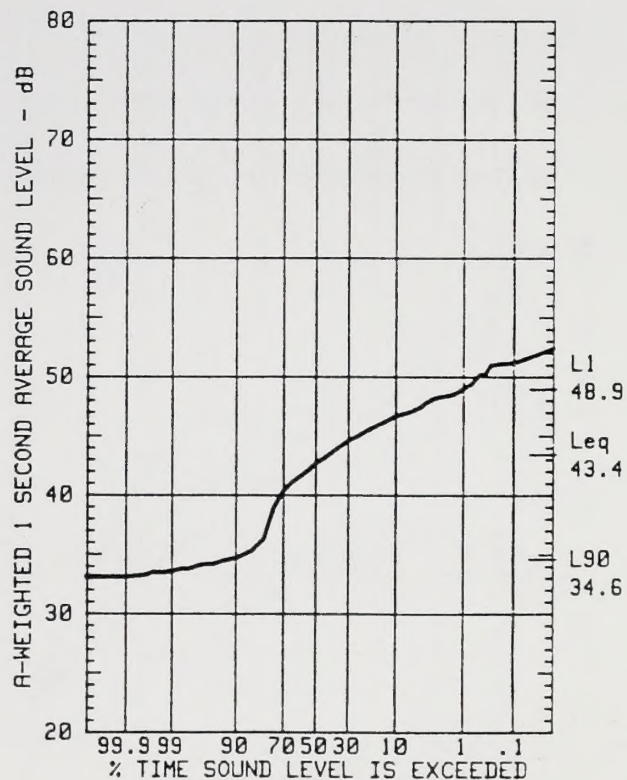
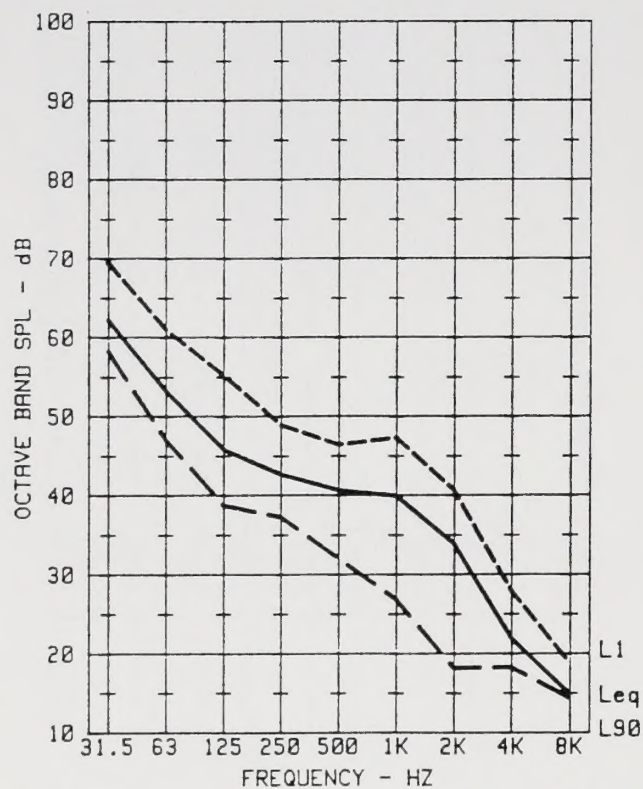
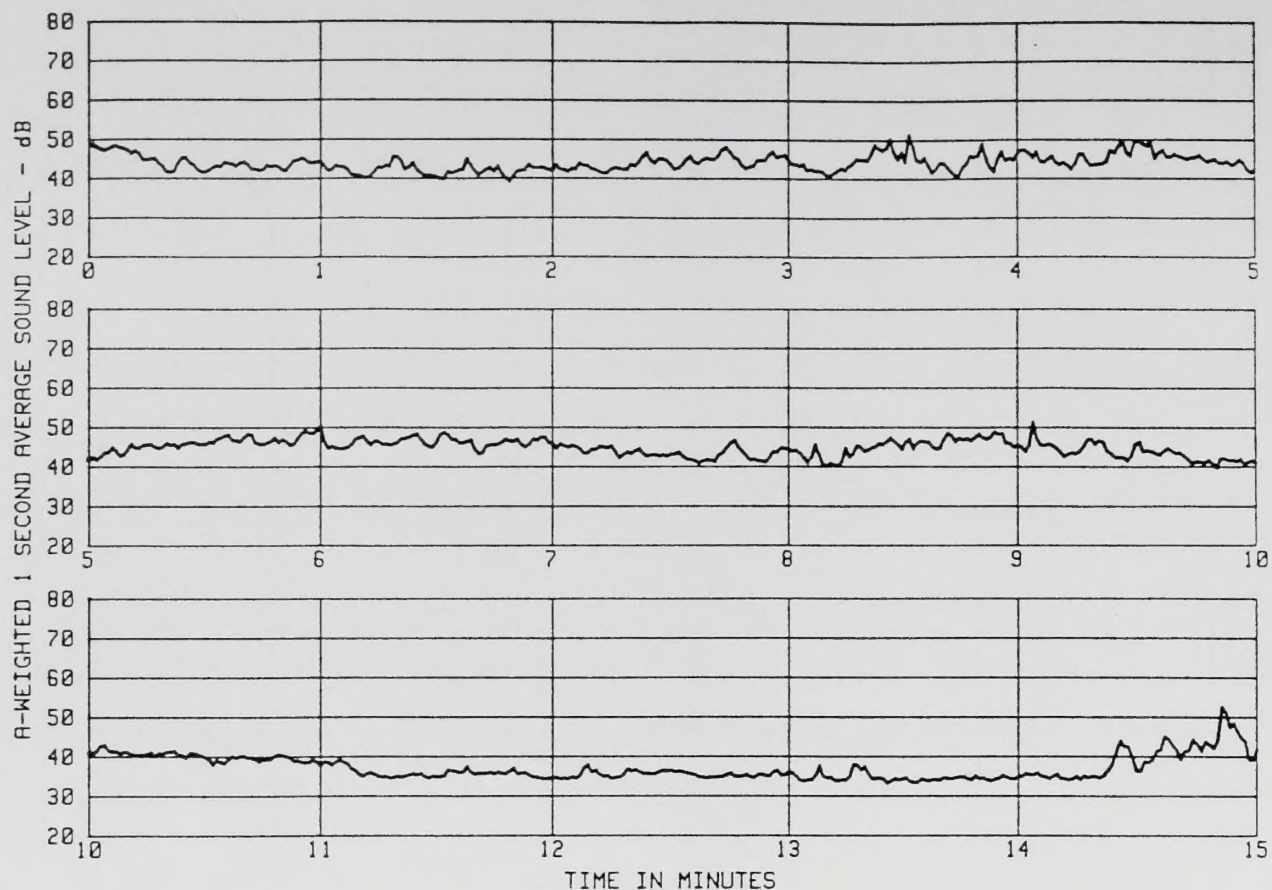
RAND MINING BALTIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 NORTHERLY END OF OLD BUTTE AT FENCE LINE
 05-24-1994 22:59-23:14

WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



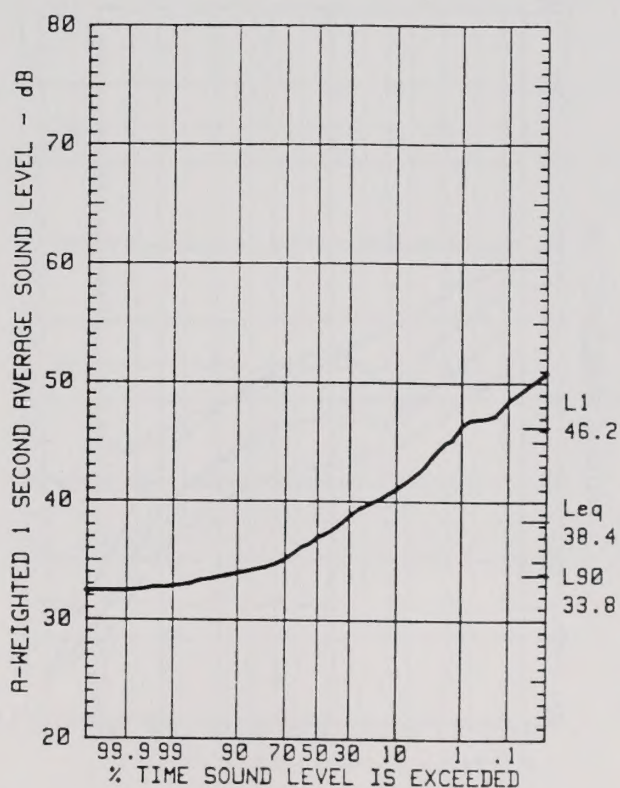
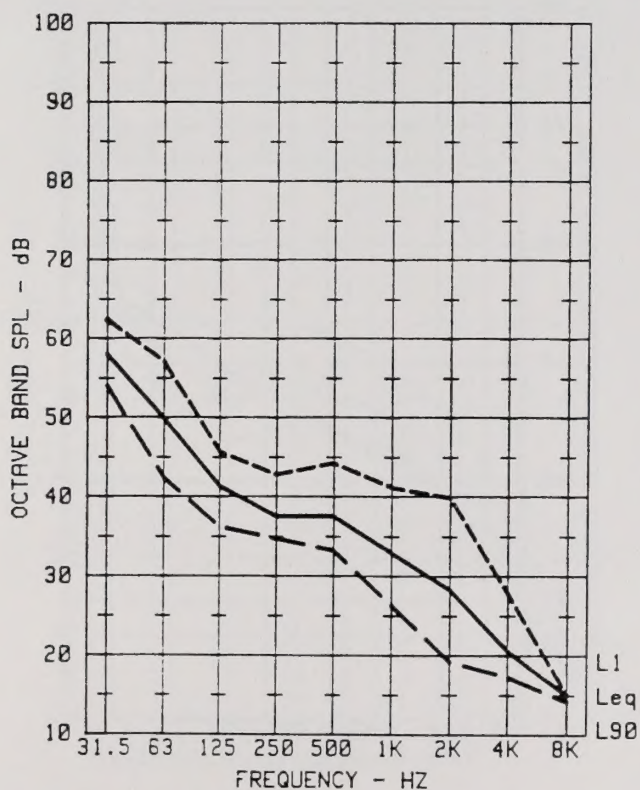
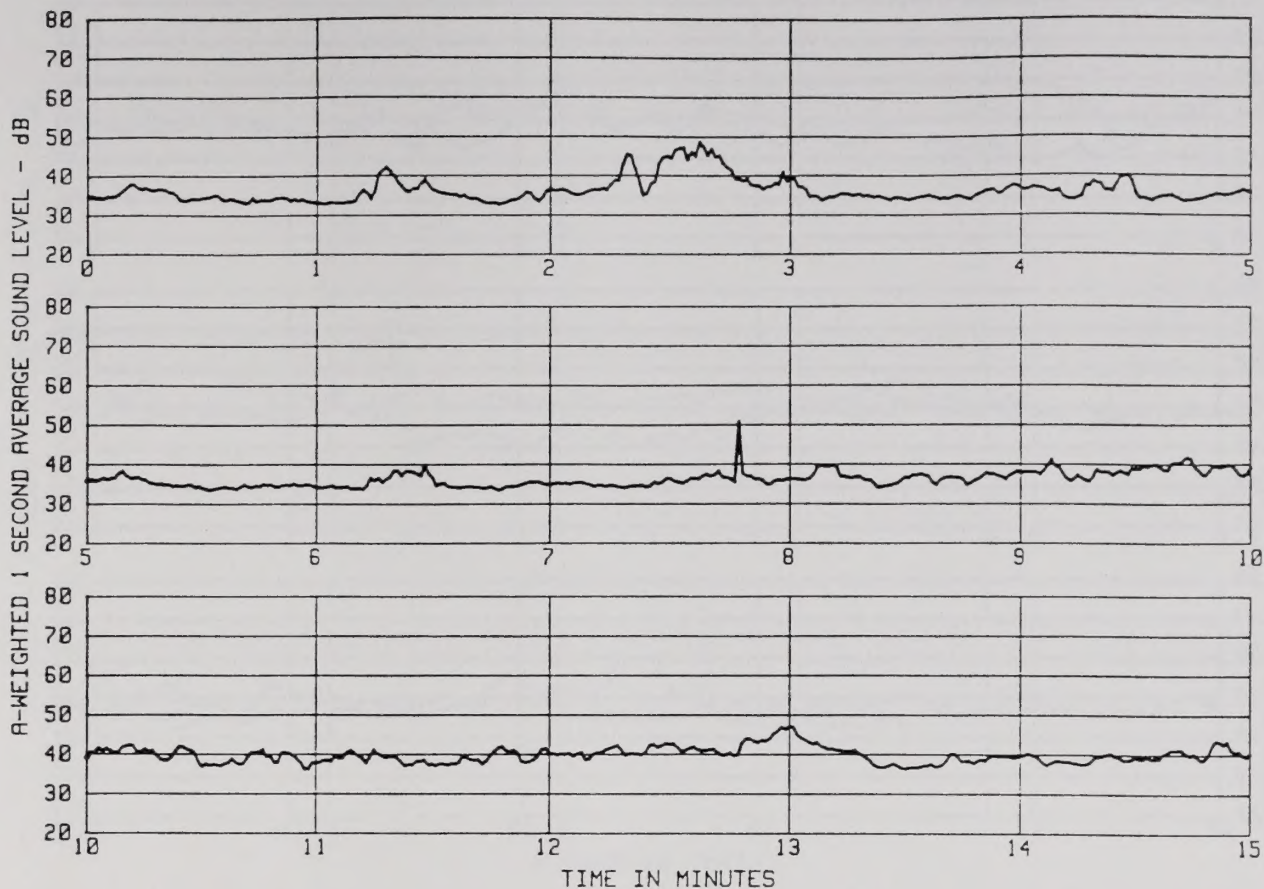
RAND MINING BALTIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 NORTHERLY END OF OLD BUTTE AT FENCE LINE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



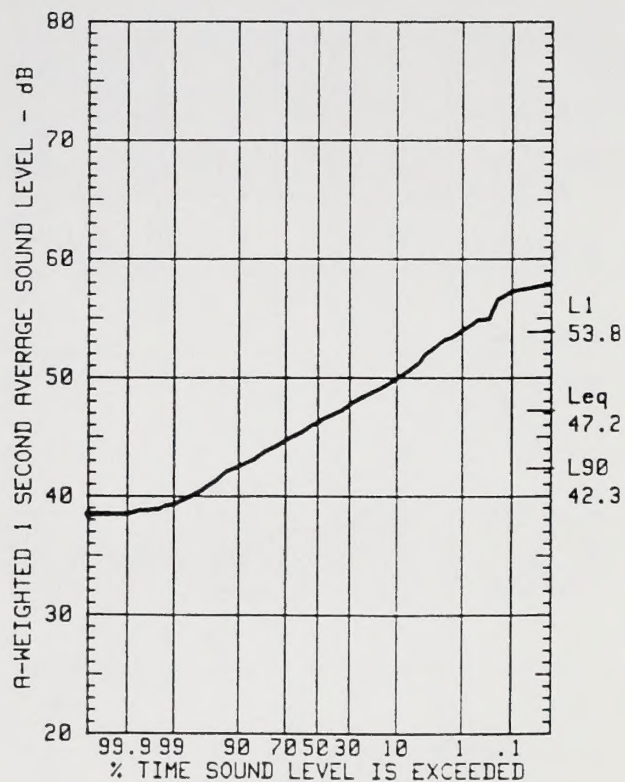
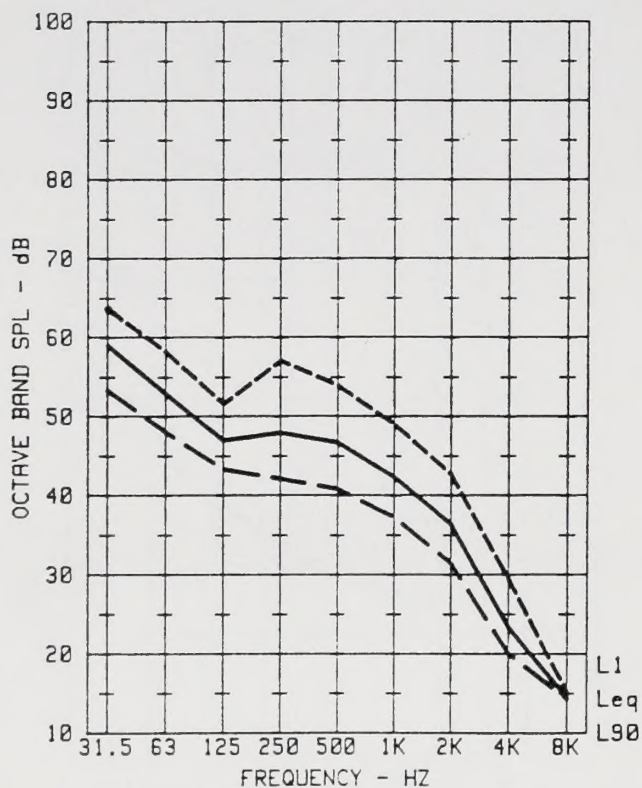
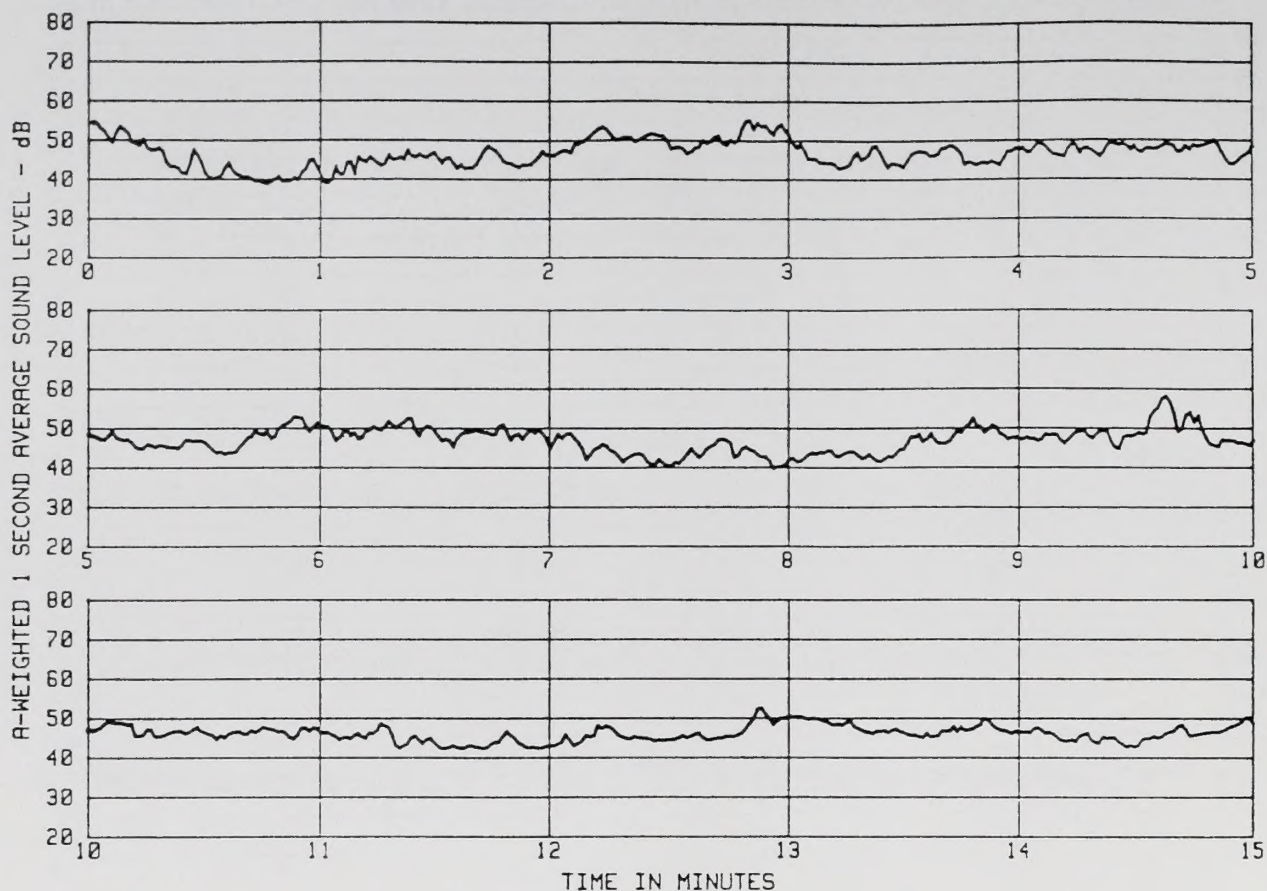
RAND MINING BALTIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 NORTHERLY END OF OLD BUTTE AT FENCE LINE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



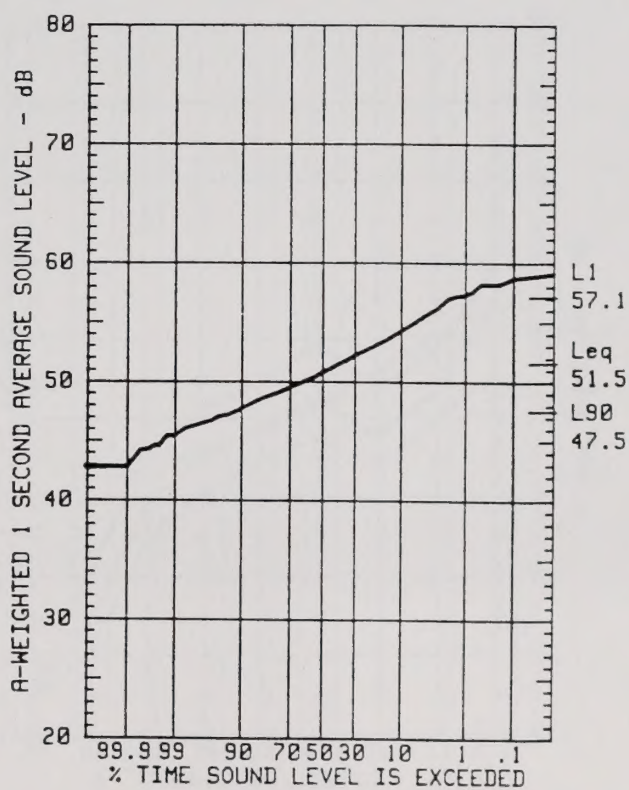
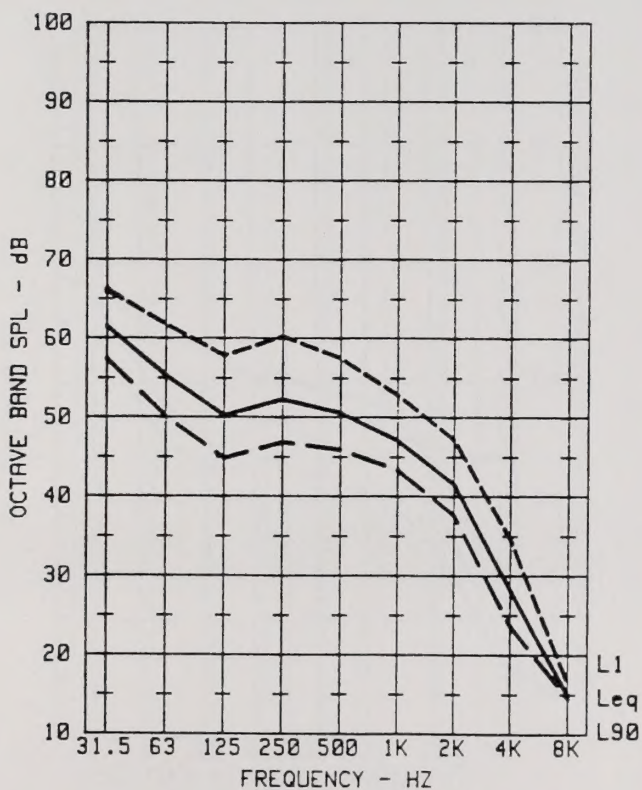
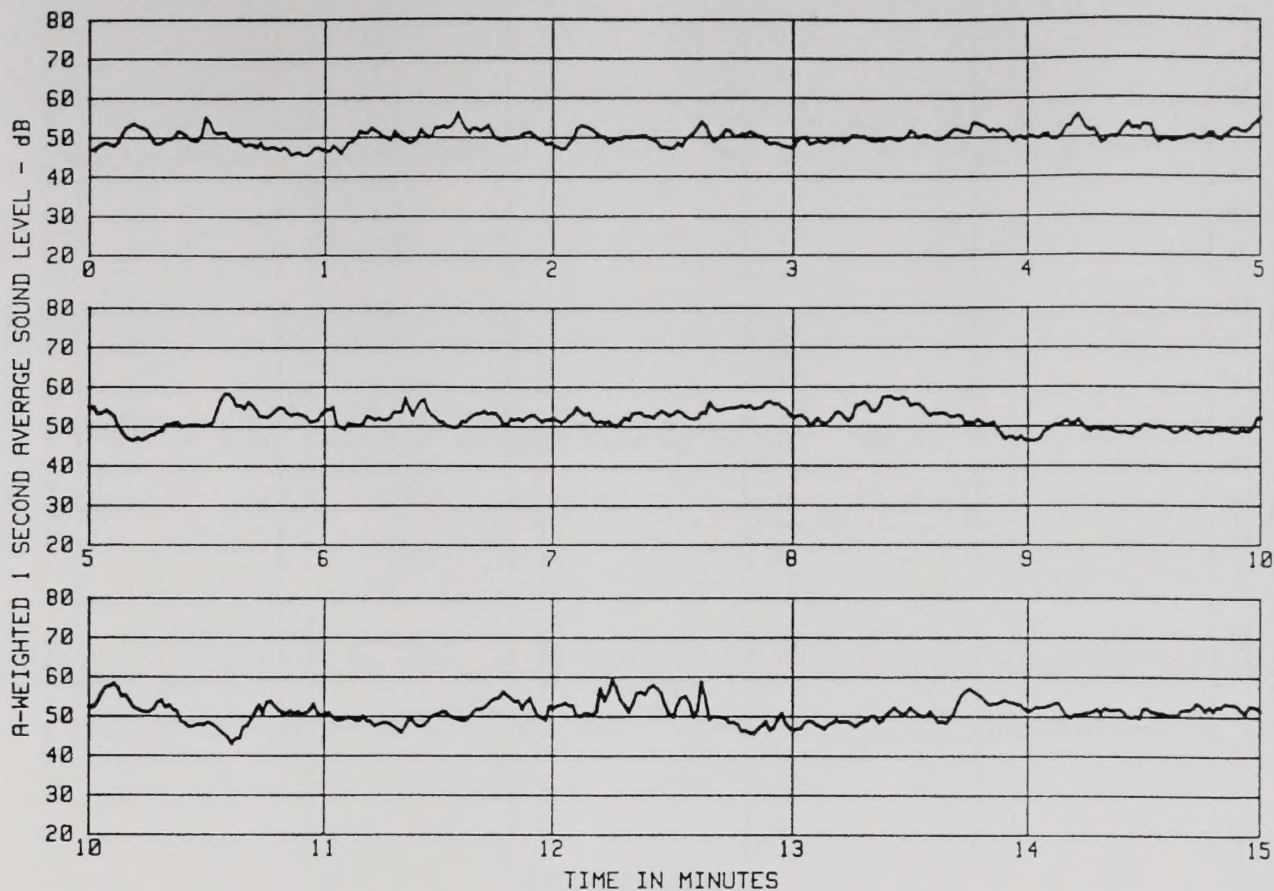
RAND MINING BALTIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 NORTHERLY END OF OLD BUTTE AT FENCE LINE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



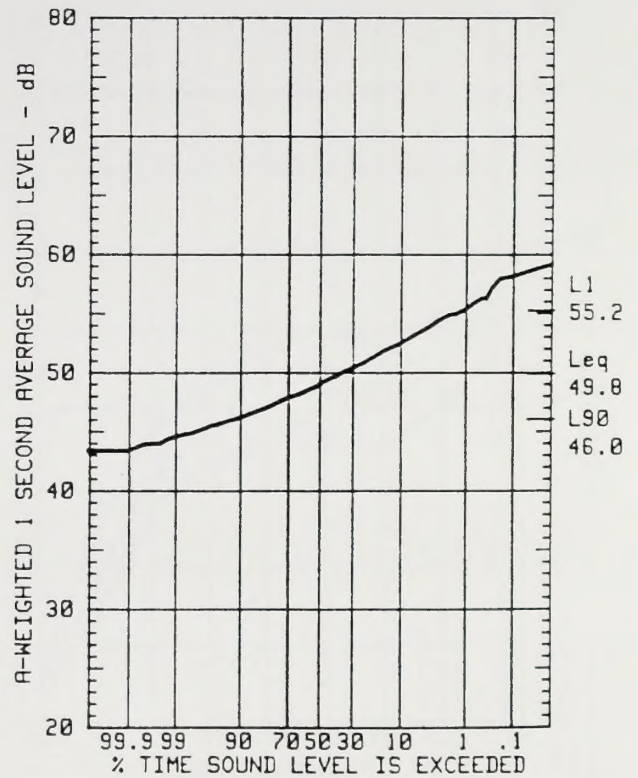
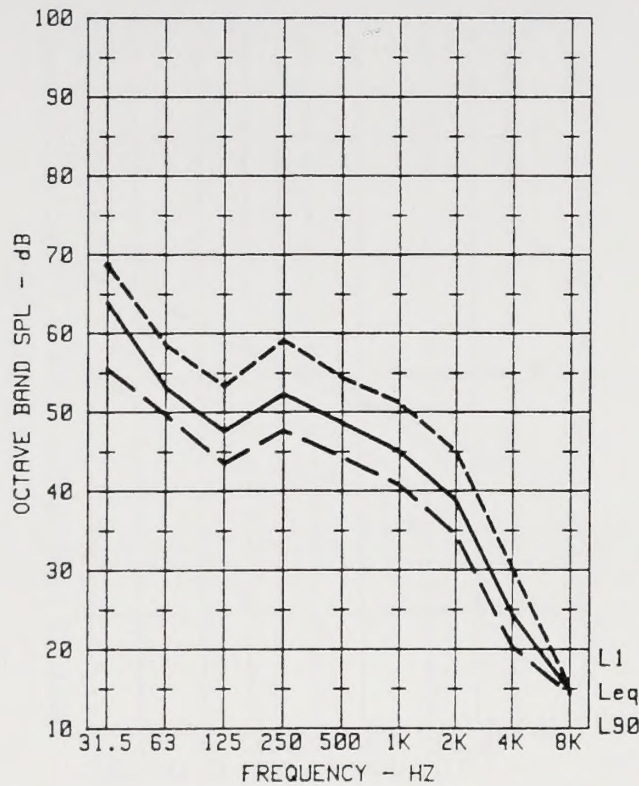
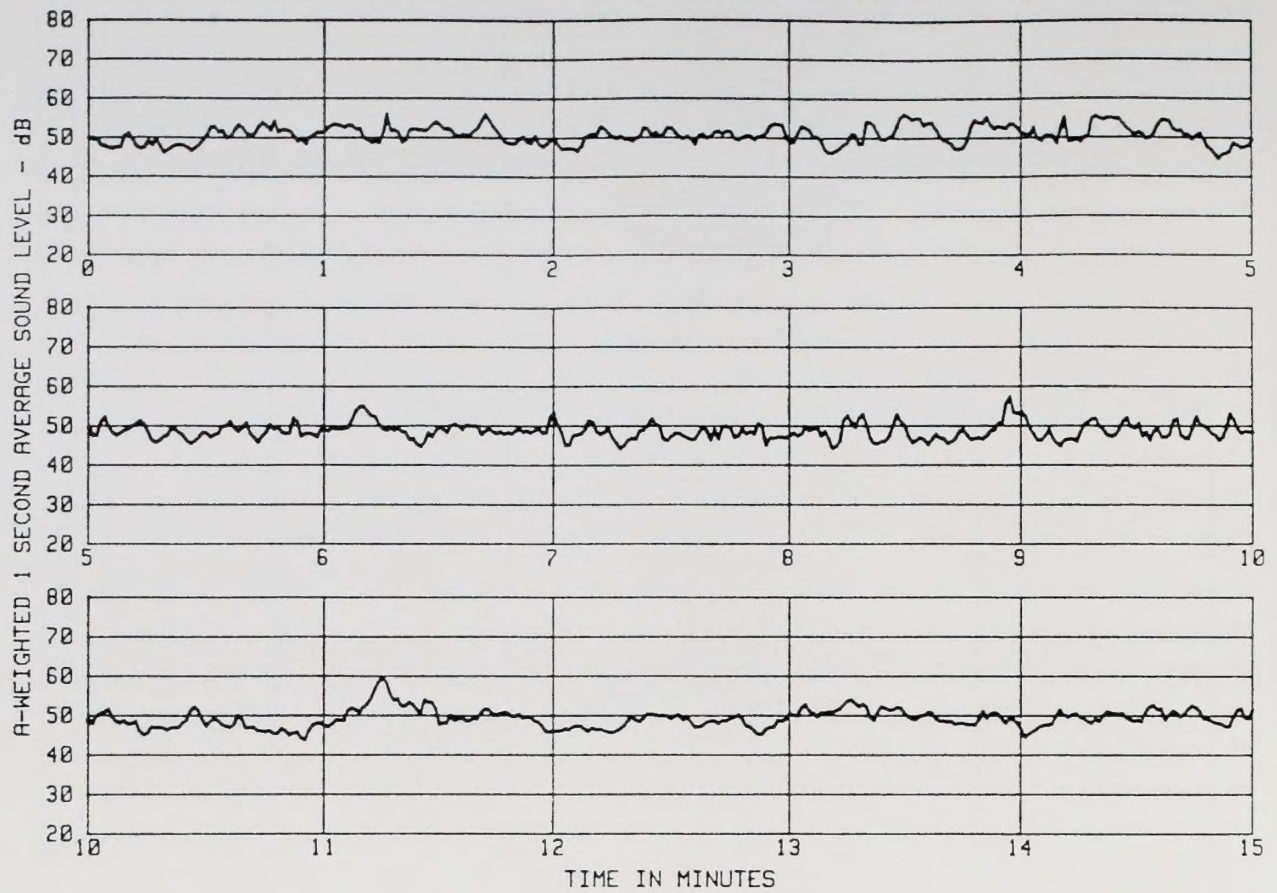
RAND MINING BALTIC PIT RANDSBURG, KERN COUNTY, CALIFORNIA
 NORTHERLY END OF OLD BUTTE AT FENCE LINE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



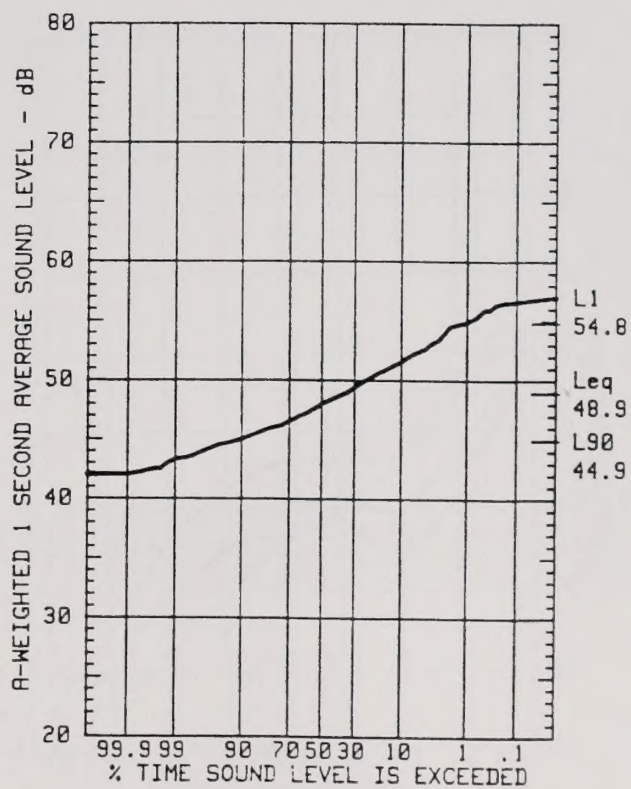
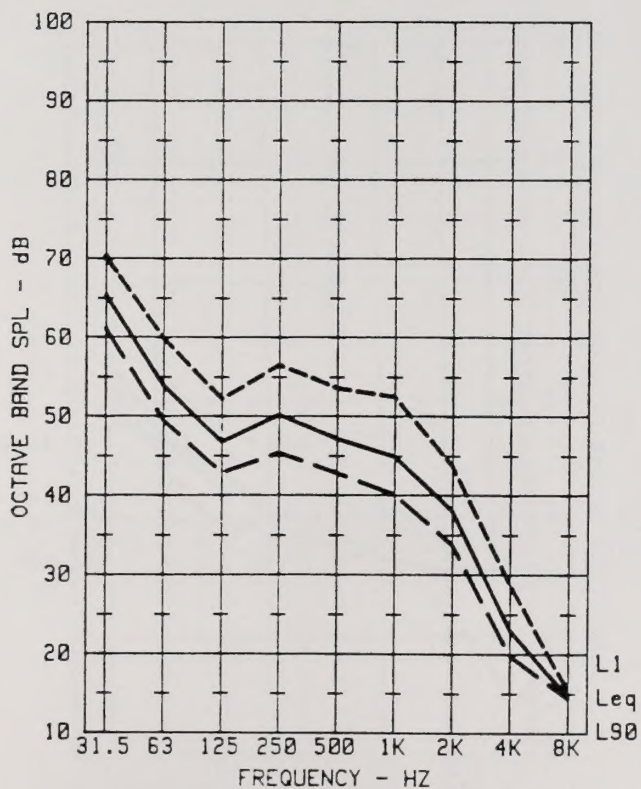
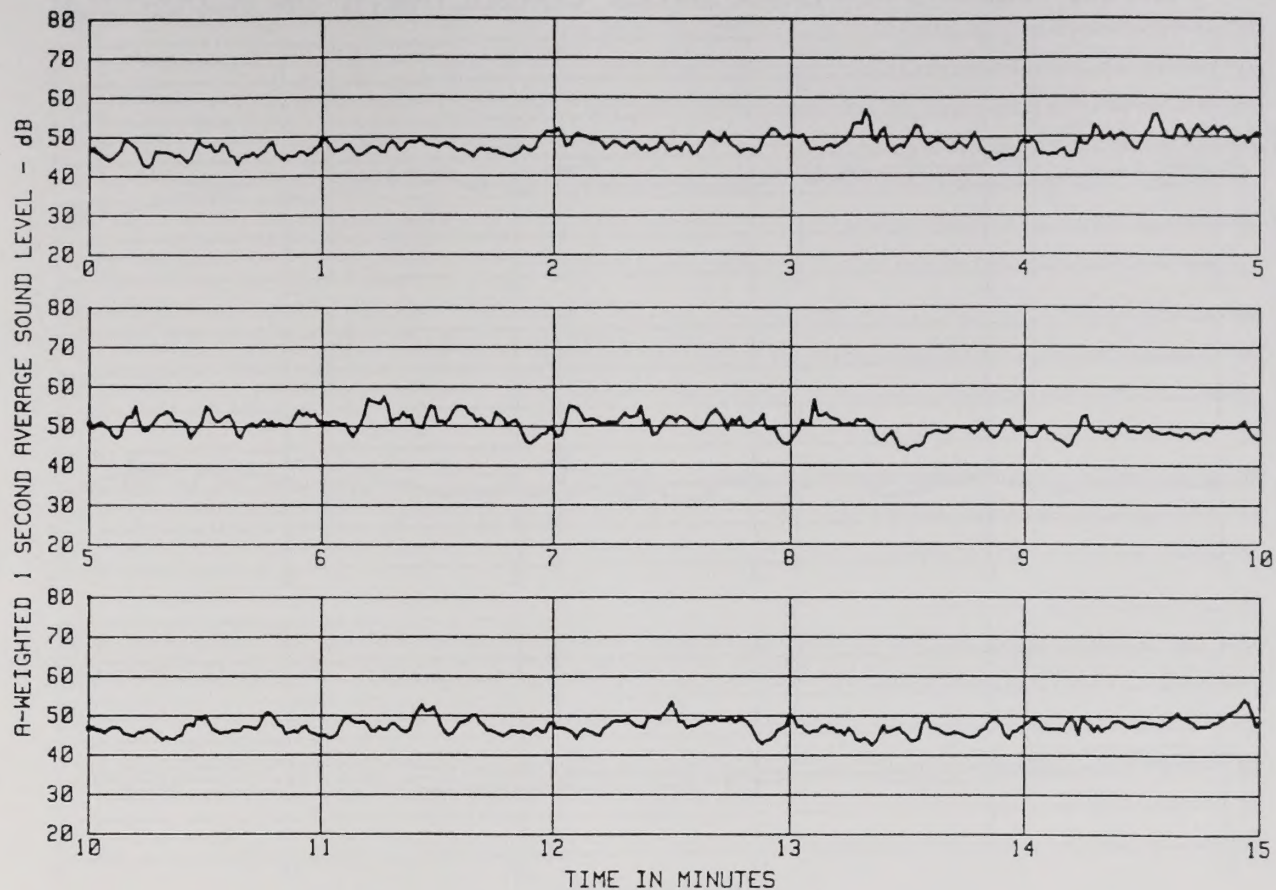
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 NORTHERLY END OF OLD BUTTE AT FENCE LINE
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WALKER, CELANO & ASSOCIATES CONSULTANTS ON ACOUSTICS



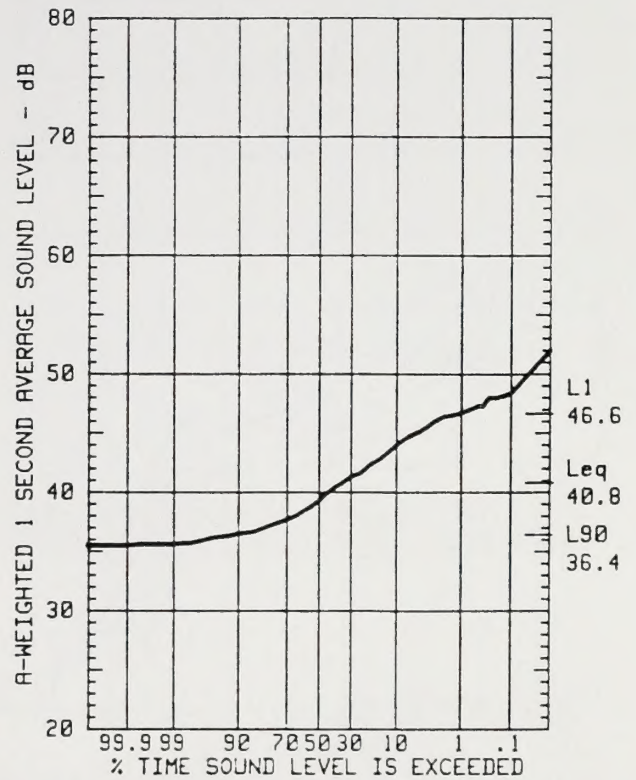
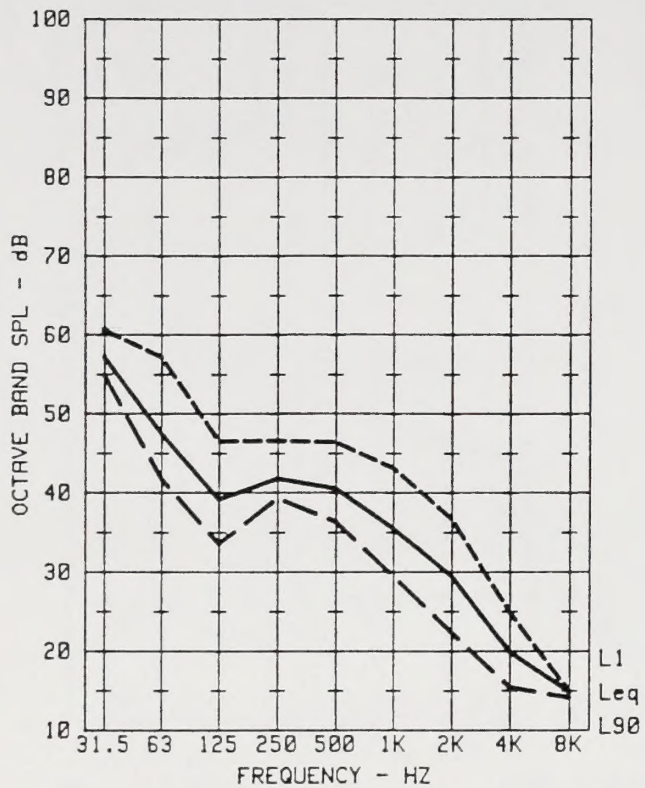
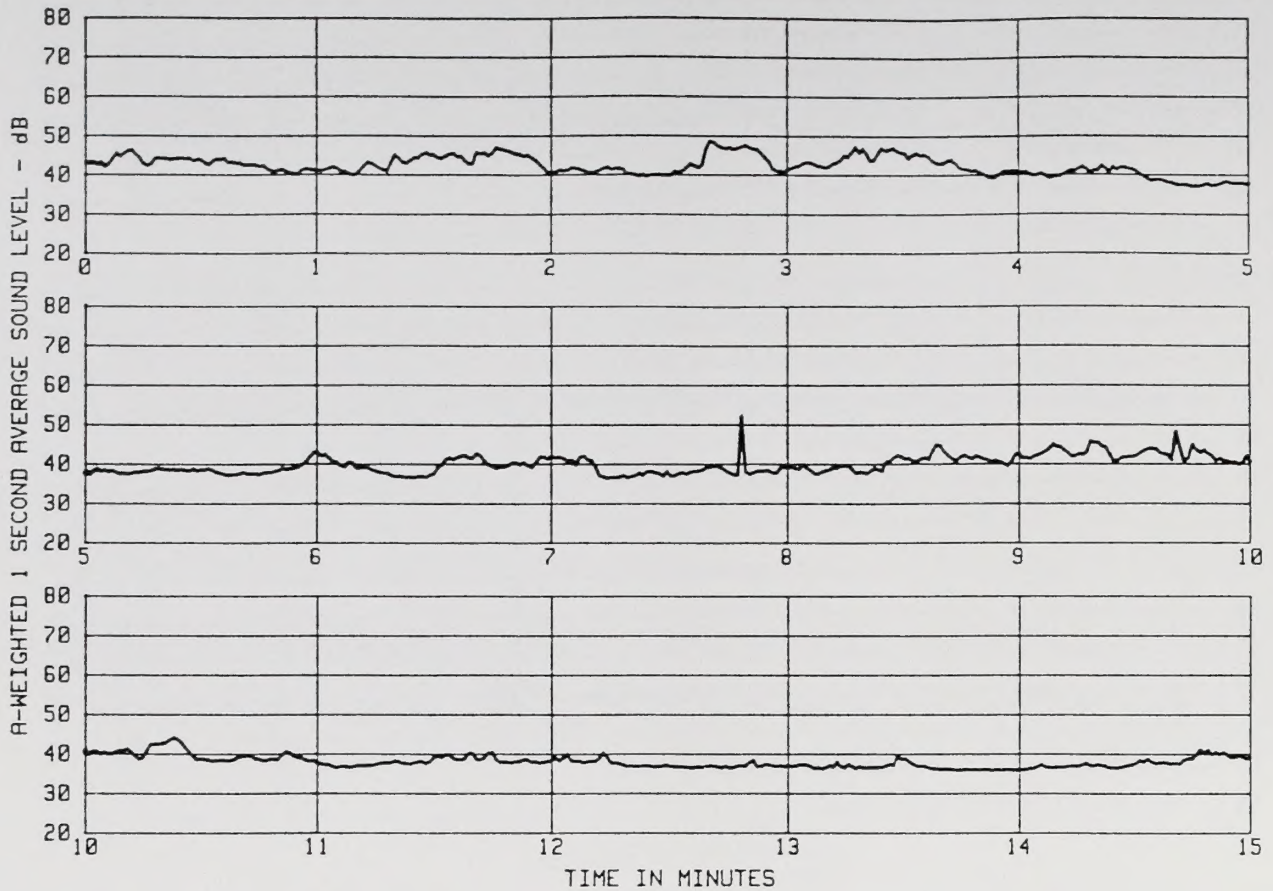
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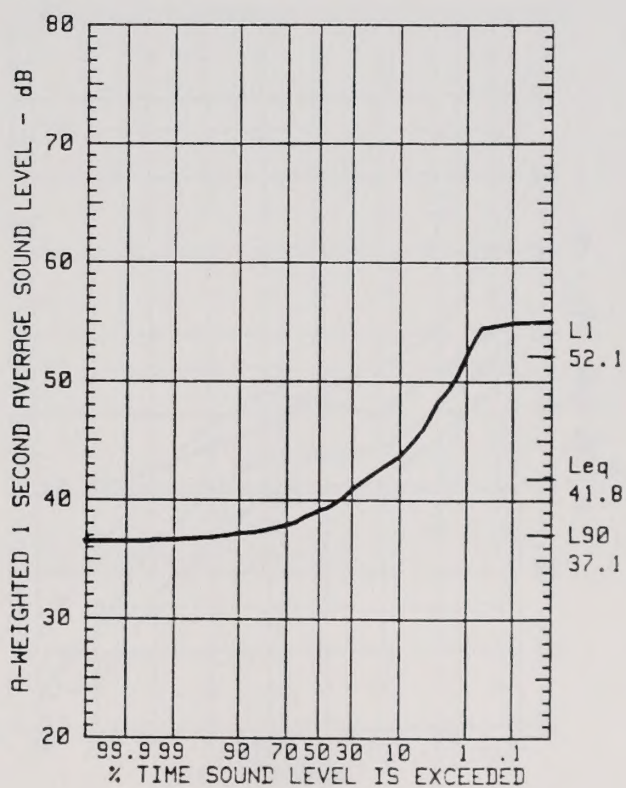
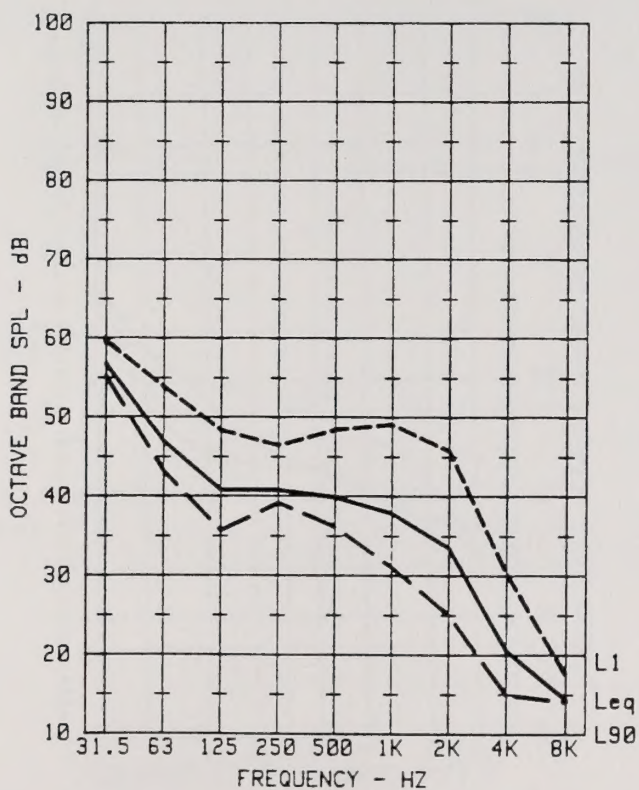
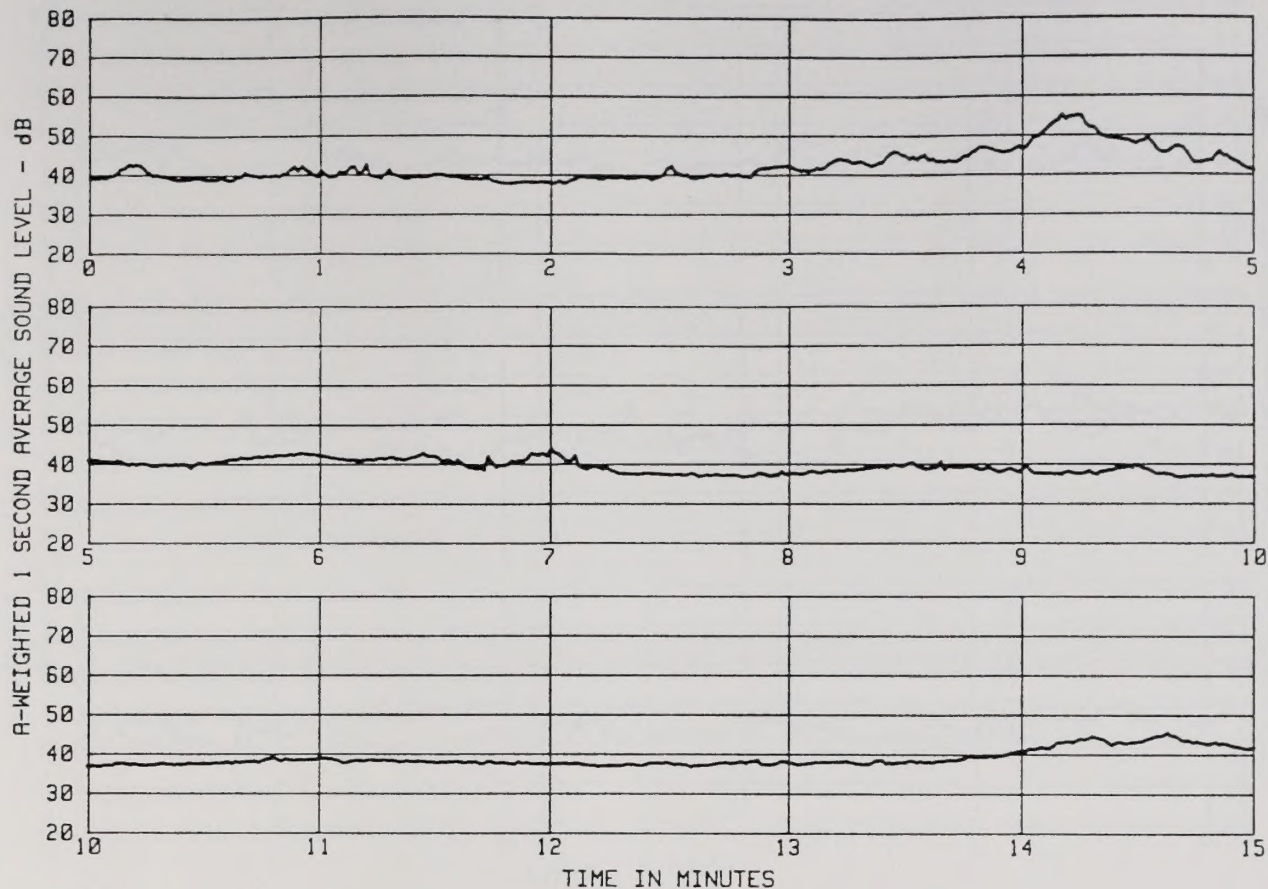
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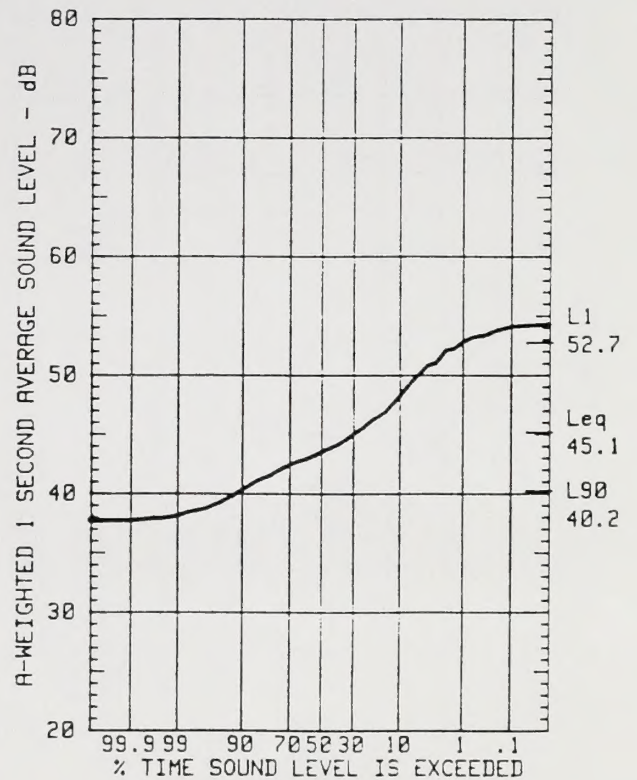
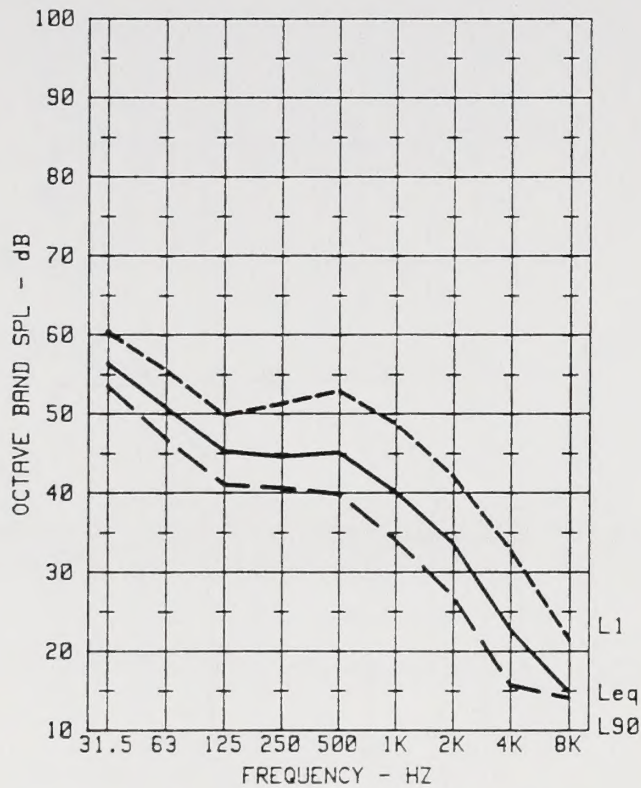
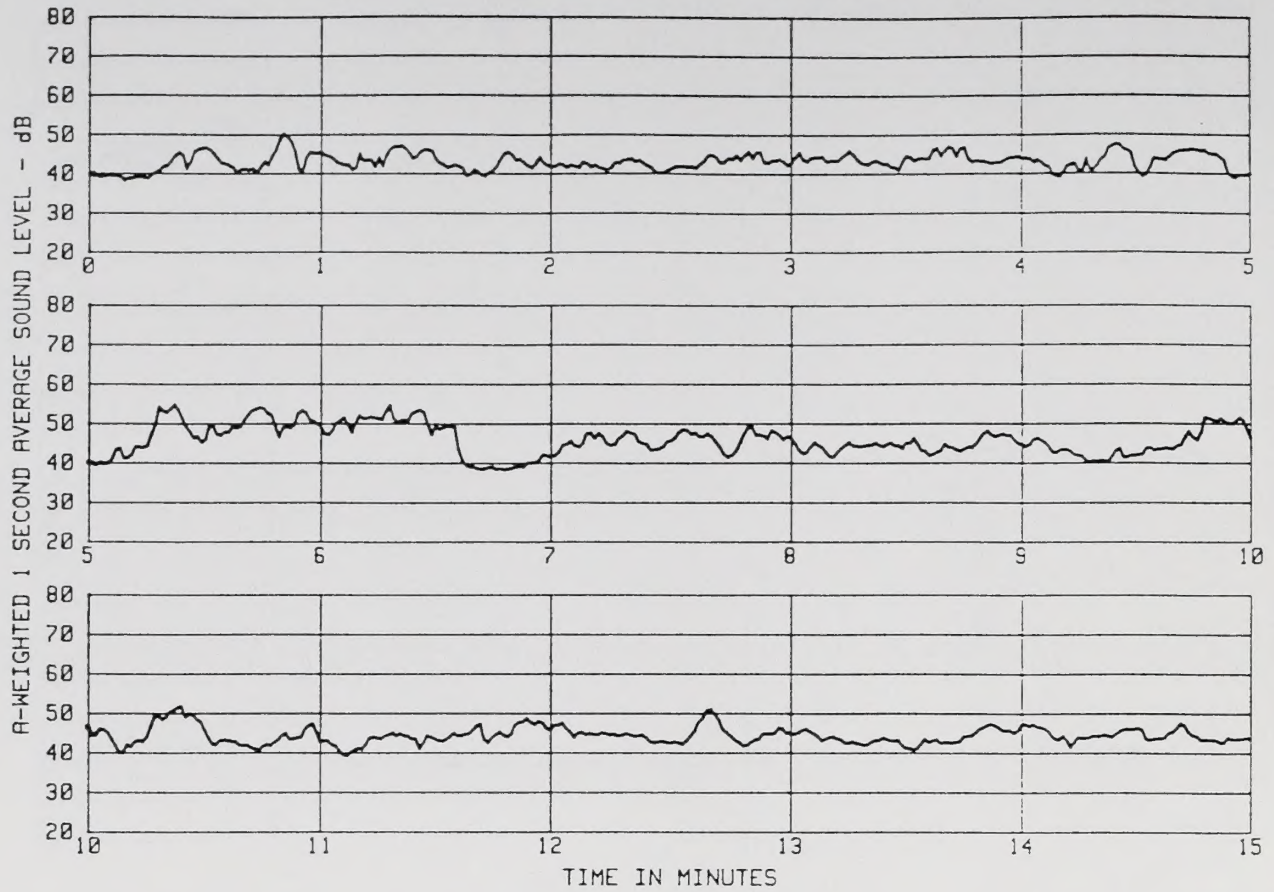
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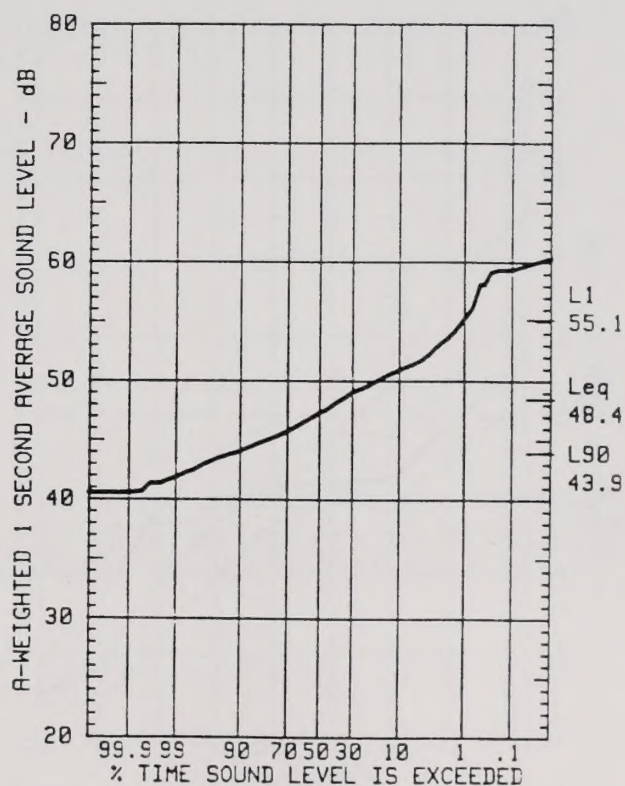
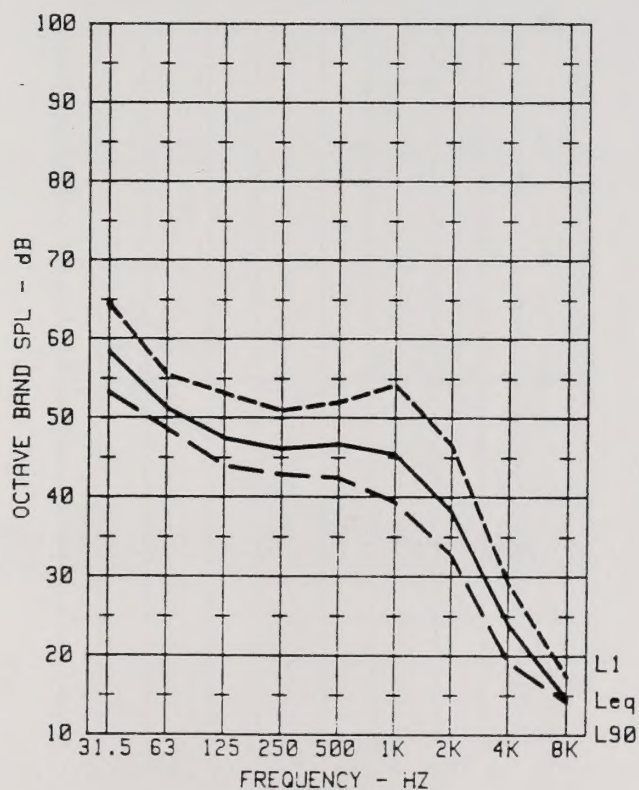
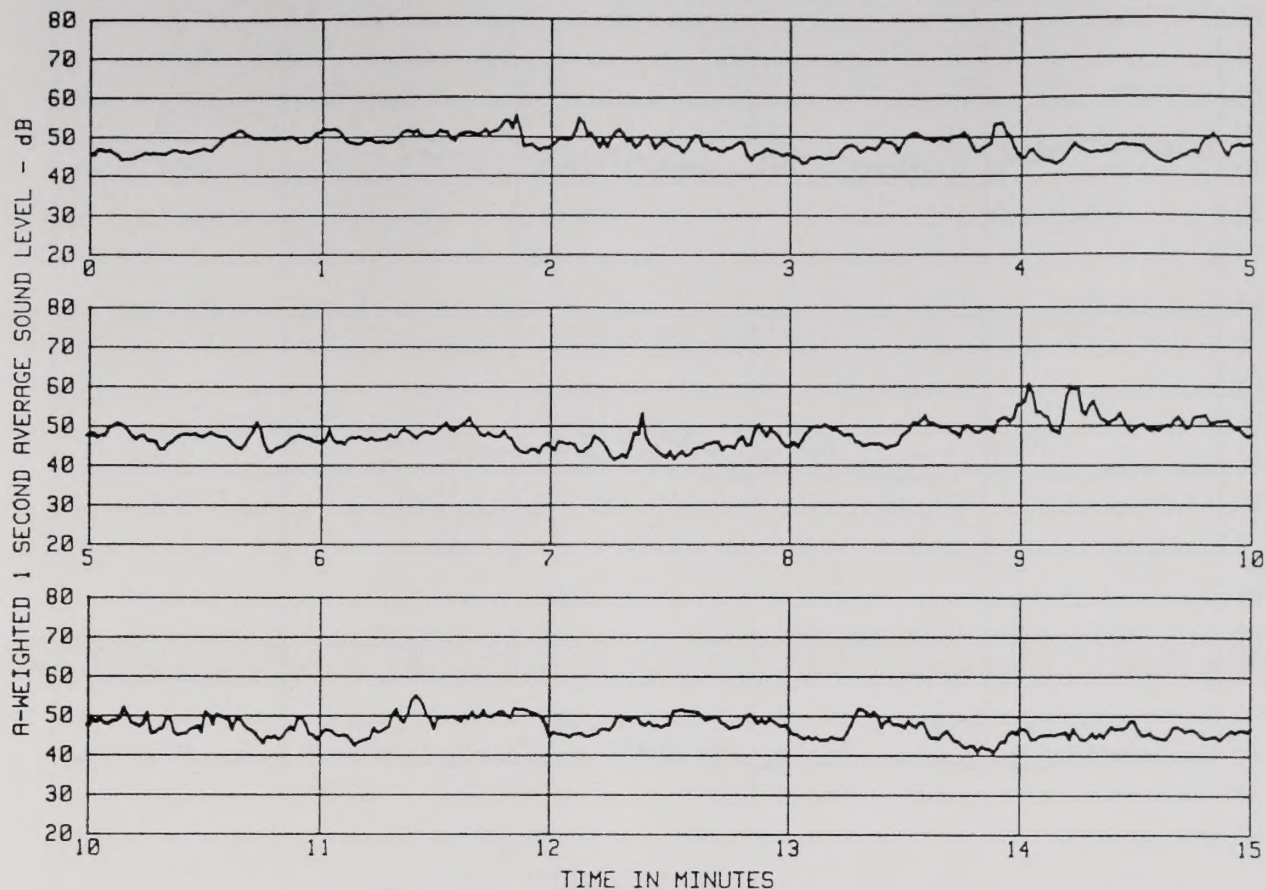
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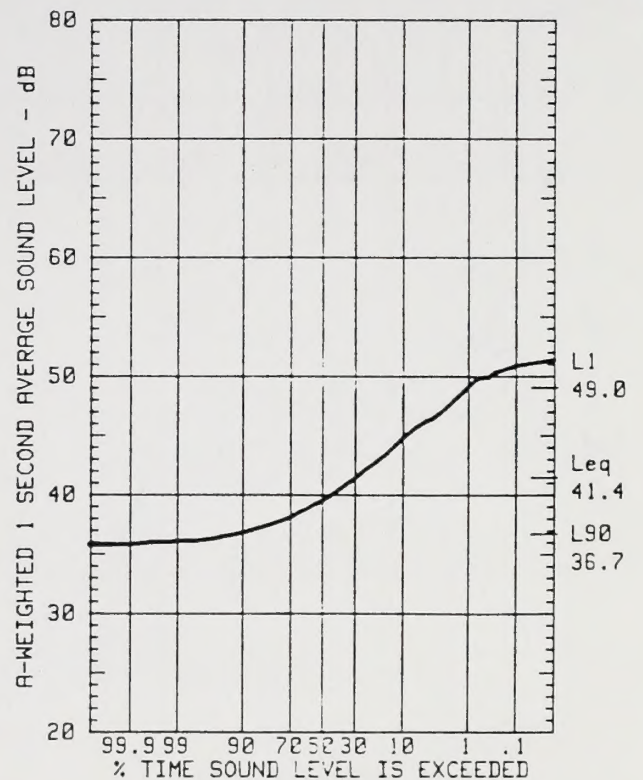
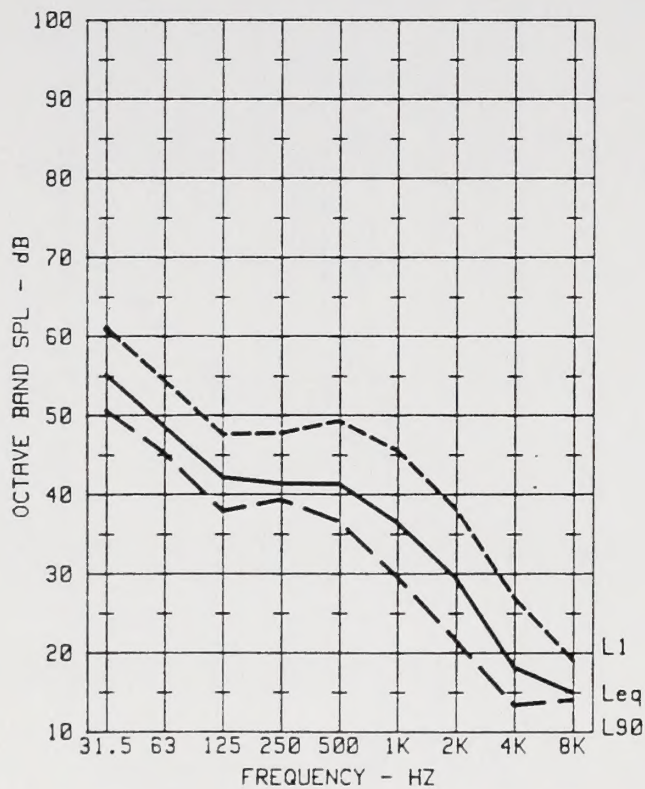
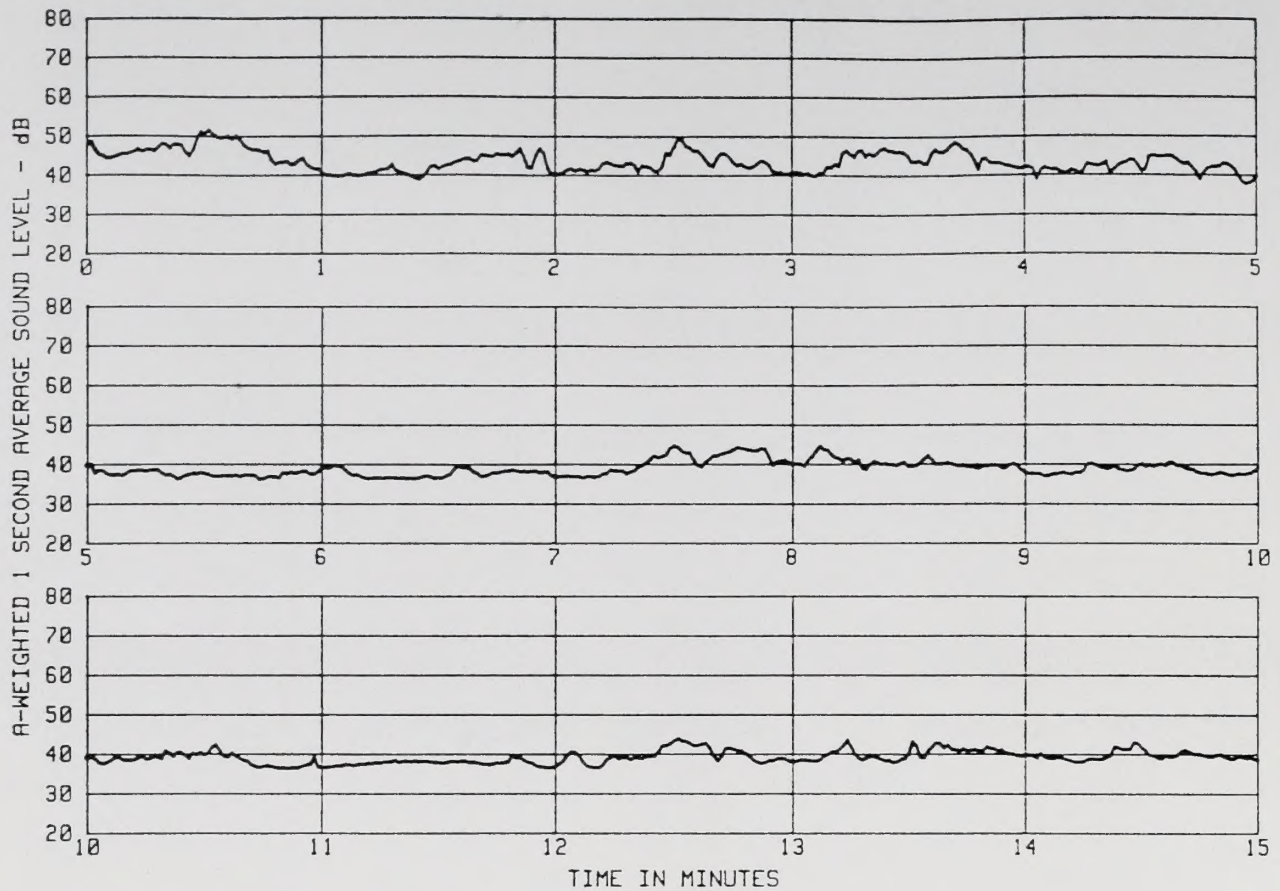
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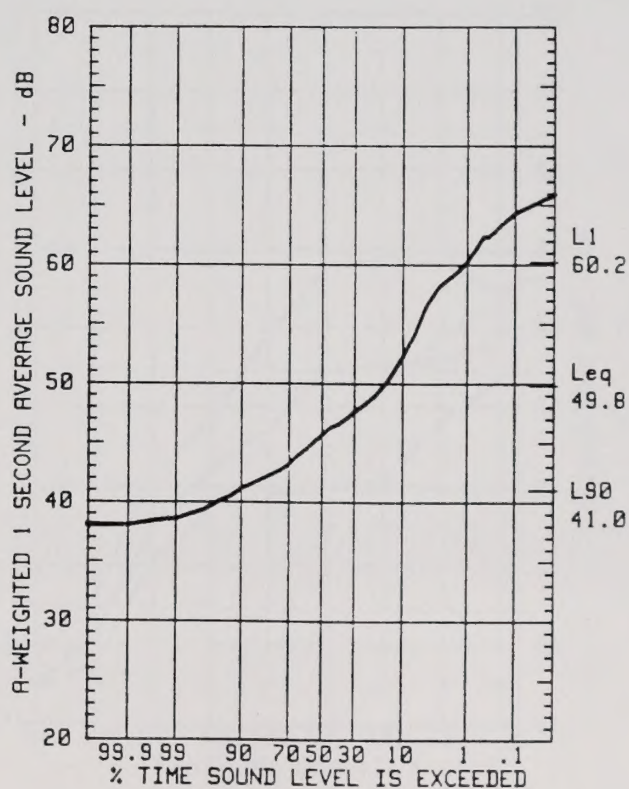
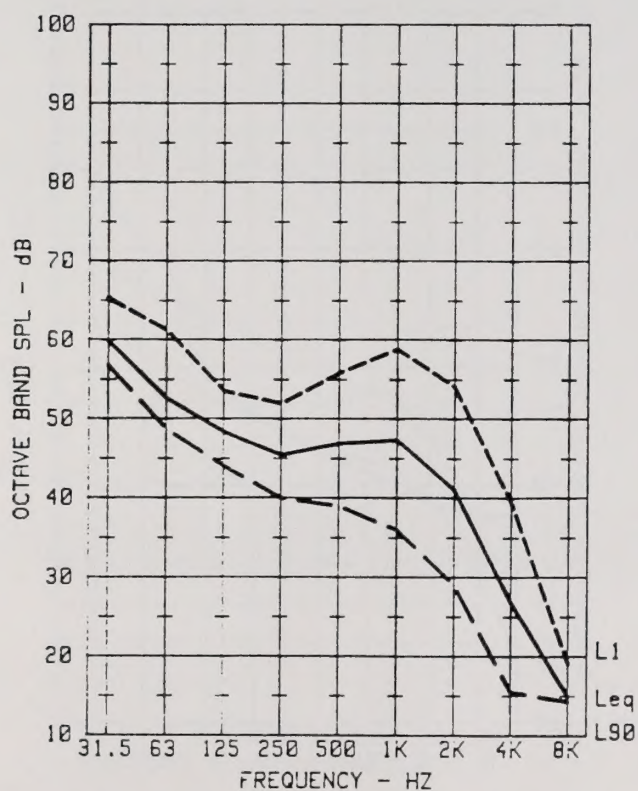
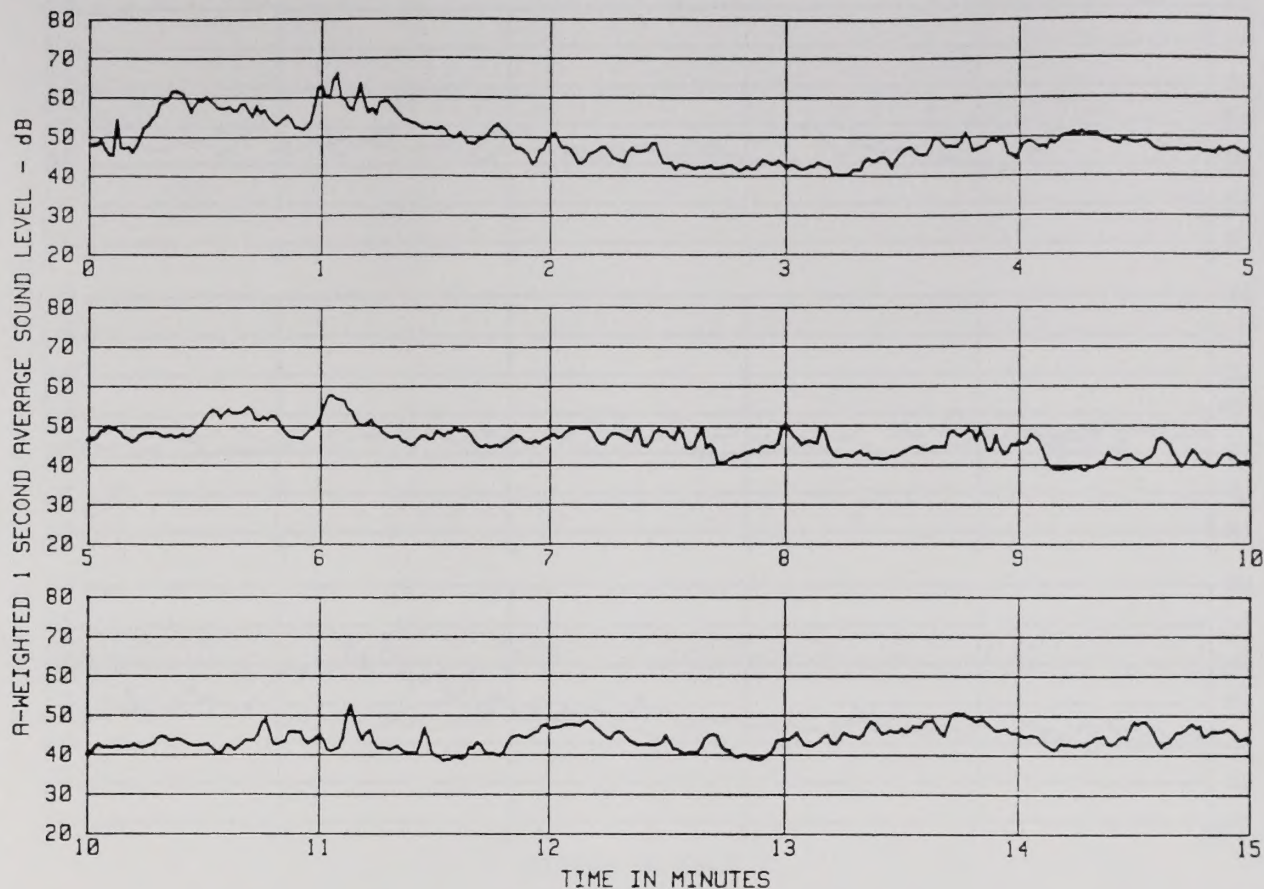
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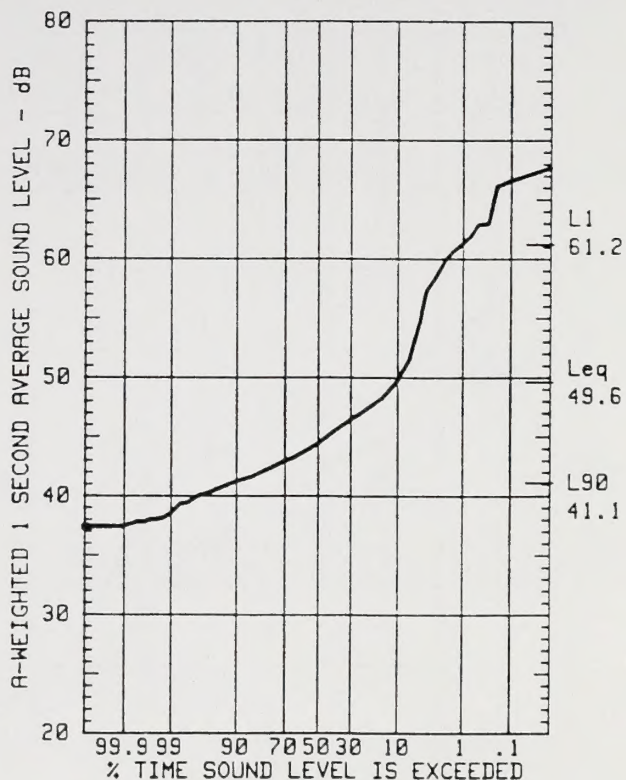
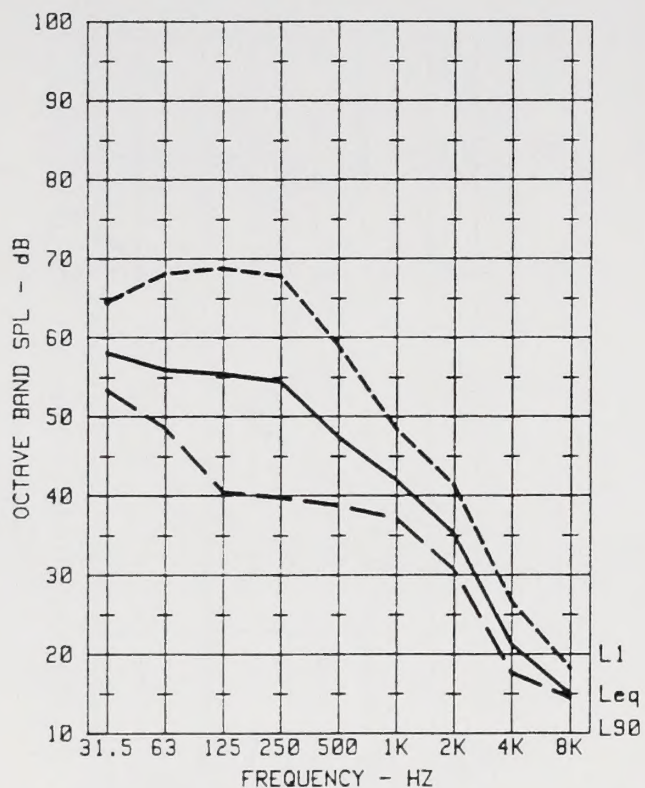
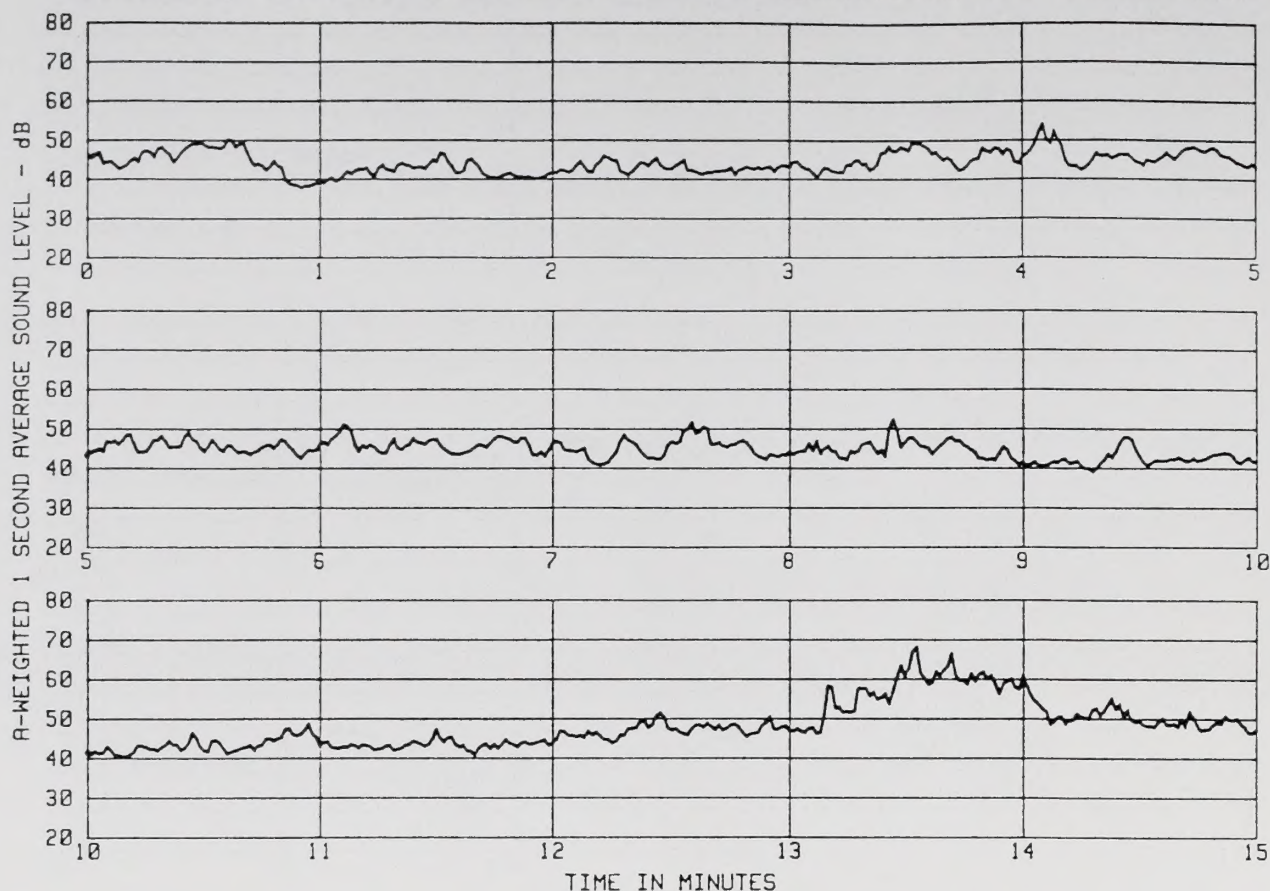
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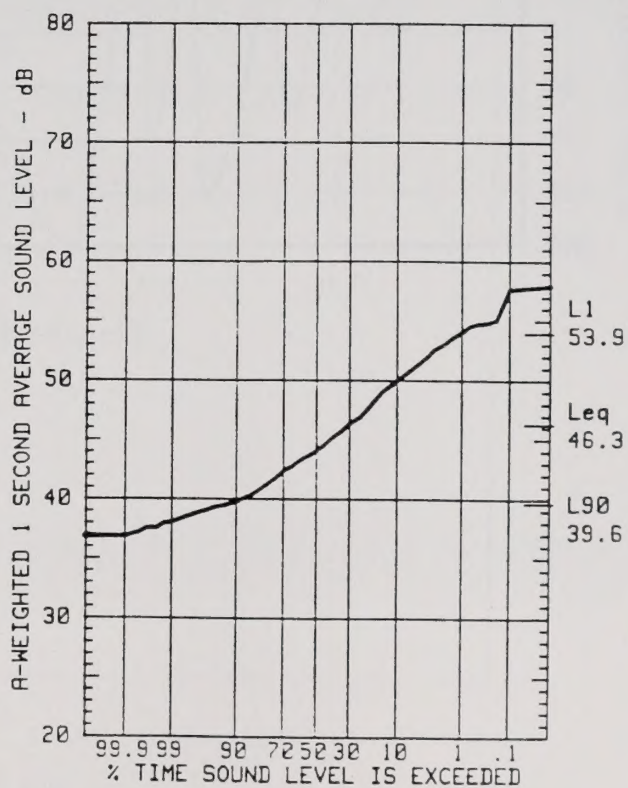
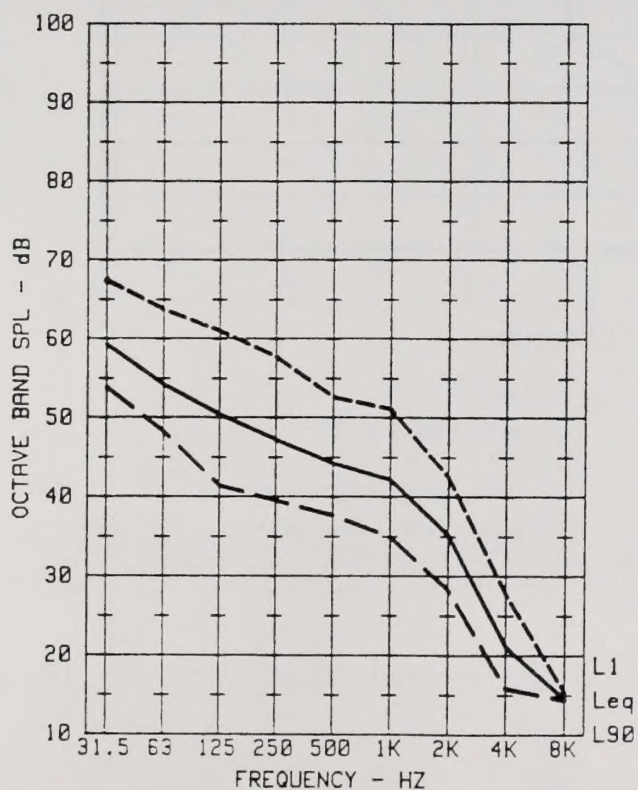
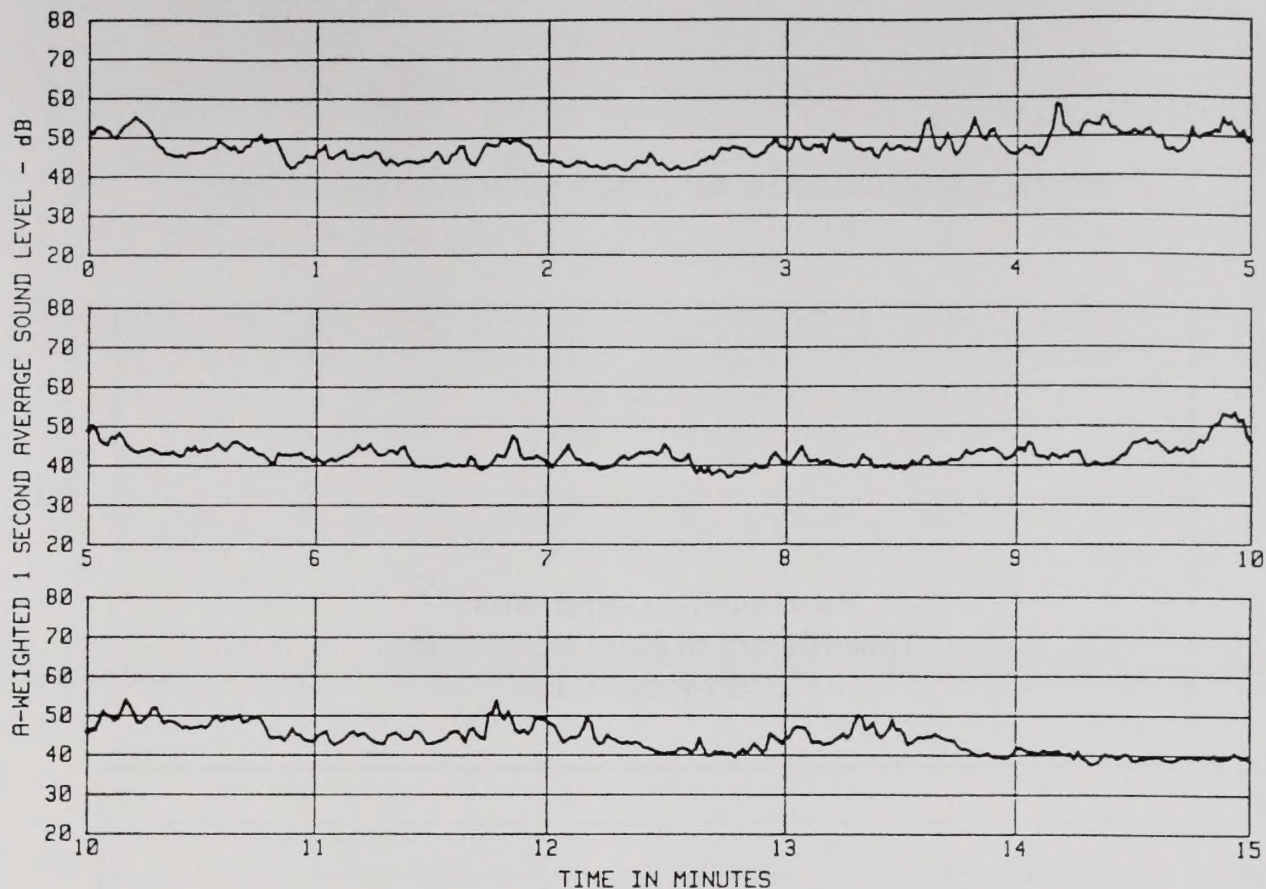
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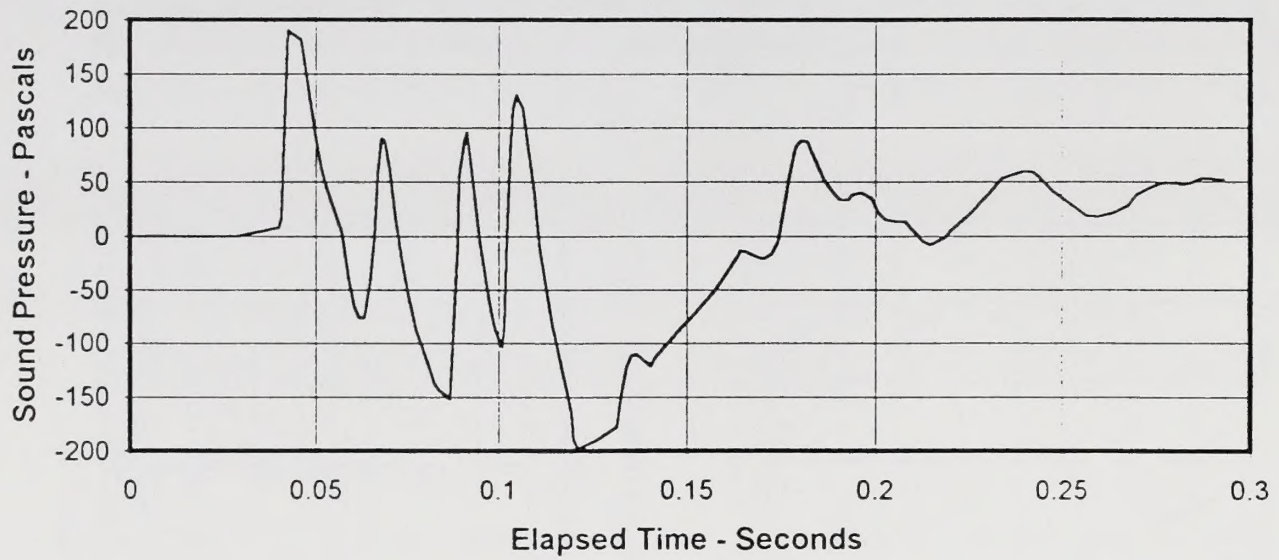
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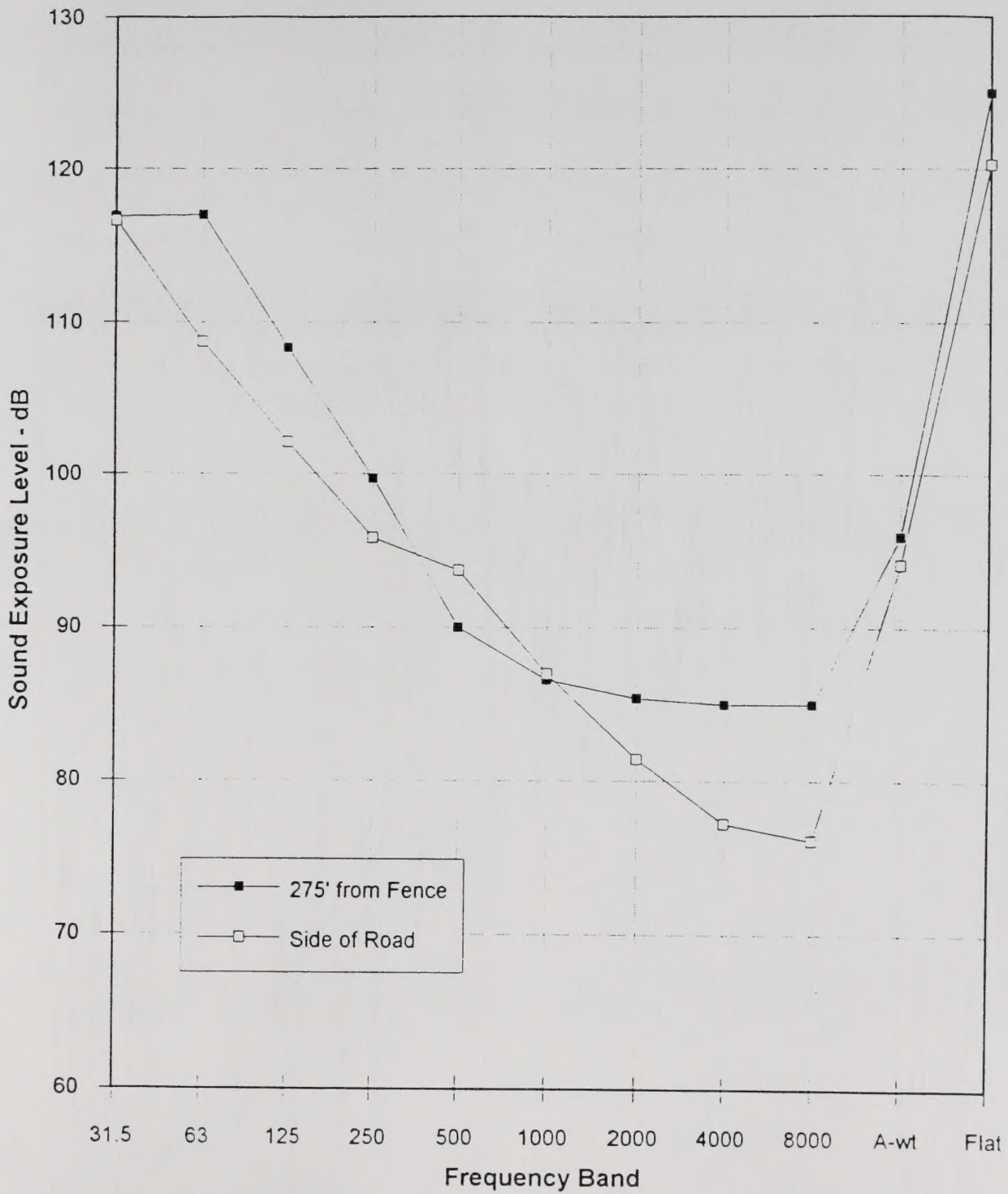


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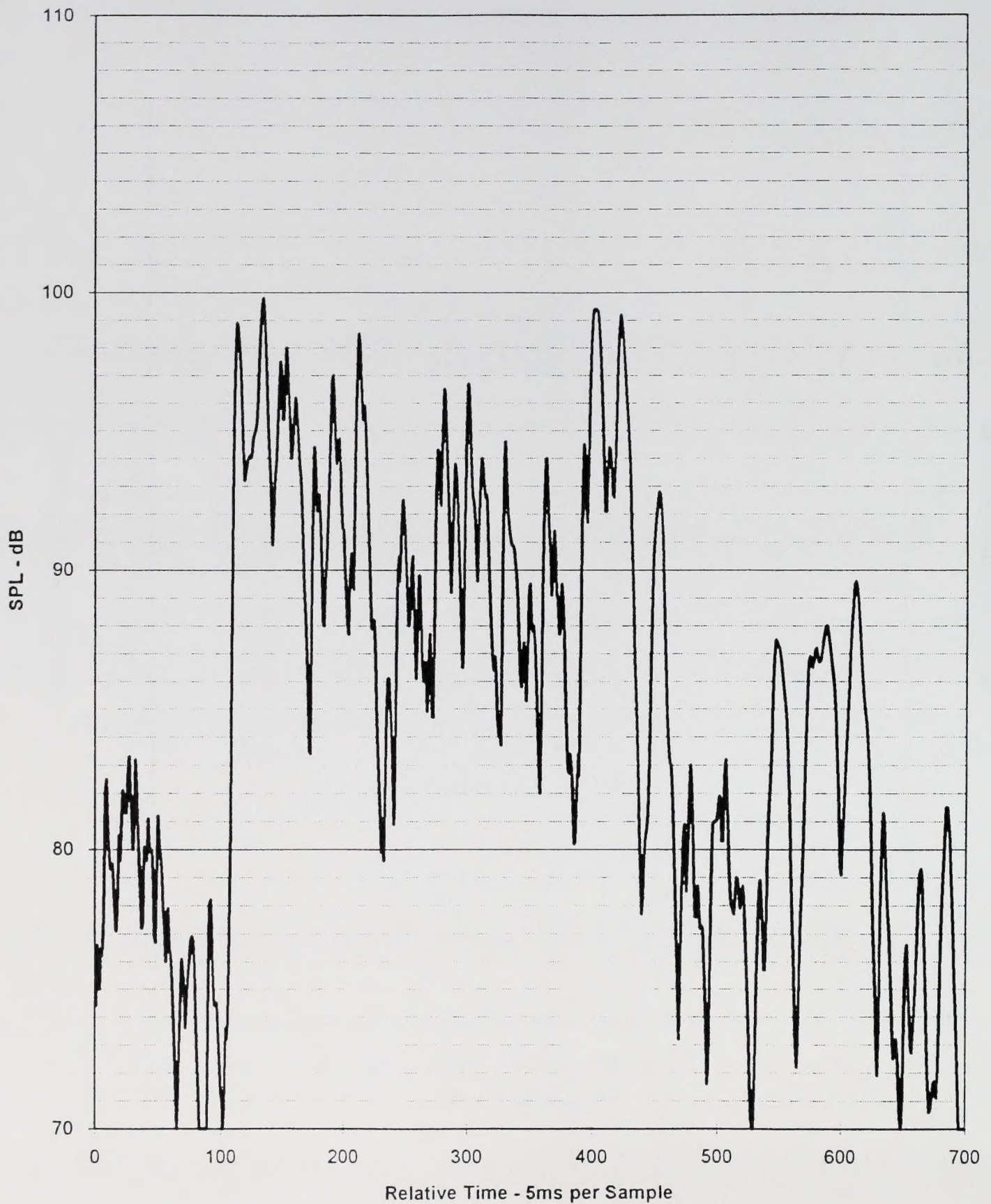
Rand Mining Corporation
Time History of Blast Noise Peak
2/16/94 3:25 p.m.



Rand Mining Corporation Blast Noise Measurement 2/16/94



Rand Baltic Blast 5/24/94
245' Southerly of Rand Fence
150' Westerly of Butte



APPENDIX L

**Biological Opinion for the Proposed Expansion of Rand
Mining Company's Gold Mining Operations Near Randsburg,
Kern County, California (CA-932.5)(1-8-93-F-30)**



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United States Department of the Interior

TAKE
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AMERICA

1993 OCT -4 PM 2:38
FISH AND WILDLIFE SERVICE

RIDGECREST RESOURCE AREA
ECOLOGICAL SERVICES
Ventura Field Office
140 E. Sunnyside Avenue, Suite 100
Ventura, California 93003

RECEIVED

OCT 06 1993

September 15, 1993

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Memorandum

RAND MINING CO.

To: State Director, Bureau of Land Management,
Sacramento, California

From: Field Supervisor, Ecological Services - Ventura
Field Office, Ventura, California

Subject: Biological Opinion for the Proposed Expansion of
Rand Mining Company's Gold Mining Operations near
Randsburg, Kern County, California (CA-932.5) (1-8-
93-F-30)

This biological opinion responds to your request for formal consultation with the Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). Your request was dated June 28, 1993, and received by us on June 30, 1993. At issue are impacts of the proposed expansion of the Rand Mining Company's gold mining operations near Randsburg (Rand Mine expansion) in San Bernardino County, California, on the desert tortoise (*Gopherus agassizii*), a federally listed threatened species.

This biological opinion was prepared using information from the following sources: your June 28, 1993, request for consultation; the biological assessment for the project (Rado 1993); informal consultation between our staffs; and our files.

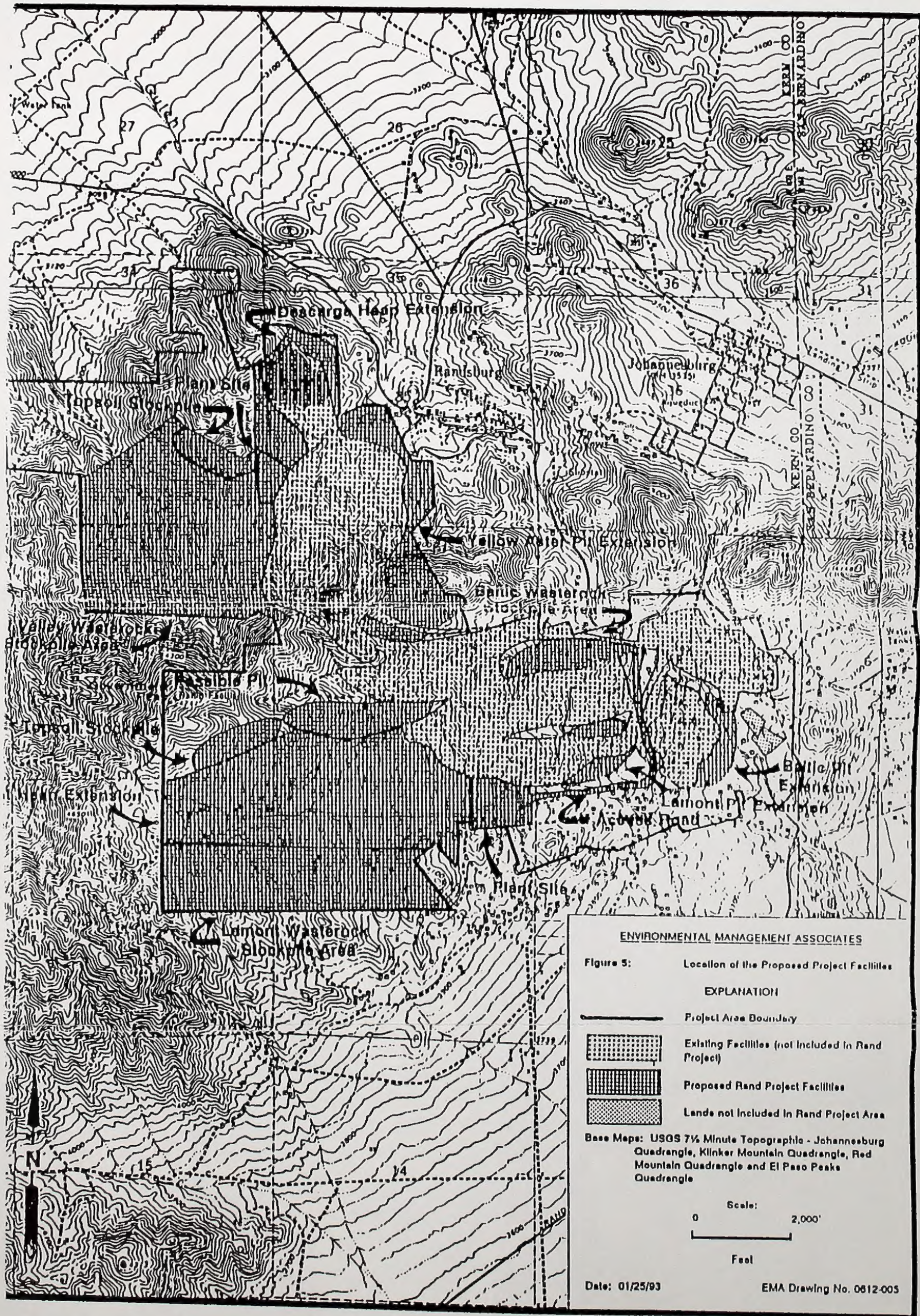
Biological Opinion

It is the opinion of the Service that the proposed project is not likely to jeopardize the continued existence of the desert tortoise. Critical habitat has been proposed for the Mojave population of the desert tortoise in California; however, the proposed action would occur outside of, and therefore not affect proposed critical habitat.

Description of the Proposed Action

The Rand Mining Company proposes to expand three existing open pit gold mining operations, including the Yellow Aster, Baltic, and Lamont operations (Figure 1). Project features include

Figure 1. Rand Project, showing projected buildout and existing development in area (Source: Rand Mining Company)



Source: Environmental Management Associates 1993;
Printed With Permission of Rand Mining Company

development of two waste rock stockpiles and two heap leach pads, development of satellite gold deposits, construction of two mineral recovery plants and other ancillary facilities, and creation of access roads to these sites. Project features, which are described in detail below, would encompass no more than 1,020 acres adjacent to the existing mines.

Project Features:

1. Mining operations. Between 45,000 and 50,000 tons of material would be mined daily from the expansion area. Ore would be extracted by drilling and blasting, and then hauled to heap leach pads for processing. Waste rock would be stockpiled. Mining techniques are described in detail in Environmental Management Associates (1990, 1992).

2. Waste Rock Stockpiles. Waste rock would be stored in two new stockpiles, each with a capacity for 72 million tons of rock. Additional waste rock may be stored in an expansion of the existing Baltic Mine stockpile.

3. Heap Leach Pads and Processing Plants. Two new ore processing, heap leach facilities would be constructed. Development of these facilities would involve construction of a 270-acre heap leach pad in the Lamont Valley and a 60-acre pad in the Descarga area (Figure 1). Construction would include grading of the site; construction of perimeter roads, containment dikes, and collection ditches; and placement of an impermeable liner on the pad. The Lamont Valley pad would be constructed first. Processing would include stacking ore on 25-foot high terraces, then applying a cyanide solution with a drip irrigation system. The leachate, which carries the dissolved gold, would be transported via the collection ditches to solution ponds and processing plants, where the gold would be extracted. All heap leach pads, collection ditches, solution ponds, and processing plants would be lined to prevent leakage of leachate into the soil. Processing plants would be surrounded by a containment berm; solution ponds would be covered with bird exclusion netting.

4. Related Facilities. A number of support facilities would be constructed, including offices, a maintenance shop, water facilities, explosives magazines, chemical storage areas, diesel fuel storage areas, a laboratory, and a furnace. All chemicals and explosives would be stored in conformance with State and Federal regulations. Exploratory surveying, sampling, mapping, drilling, and bulk sampling would also be carried out on the project site.

5. Mitigation Features. Rand Mining Company proposes the following measures to reduce the effects of the project on desert tortoises and their habitat:

- a. During mining and related construction, stockpiling of equipment and vehicles shall utilize those portions of the project site that will be subject to permanent disturbance, or to areas previously disturbed. Temporary or inadvertent disturbance to remaining portions of the area will be minimized by: staking, "flagging", or otherwise clearly marking the boundaries of the mining area; notifying employees of the specific areas, boundaries of the areas, and the need to avoid disturbance to remaining areas; and posting signs or erecting temporary fencing at access points to limit access to authorized vehicles and equipment only. All employees shall be instructed that their activities shall be confined to locations within flagged or marked areas.
- b. The area of disturbance shall be confined to the smallest practical area, considering topography, placement of facilities, locations of sensitive species, public health and safety, and other limiting factors. Special habitat features, such as desert tortoise burrows identified by the authorized biologist, shall be avoided to the extent possible. To the extent possible, previously disturbed areas within the project area shall be used for the placement of equipment, work staging sites, or parking of vehicles.
- c. Existing routes of travel shall be used during mining activities to the maximum extent practical in order to minimize any disturbance to desert tortoise habitat not slated for development. Speed limits on unposted access roads leading to and from the mining site, ore processing areas, equipment stockpile or overburden areas, and other facilities will not exceed 25 miles per hour. Project-related vehicle use shall be confined to designated routes.
- d. Trash and food items will be promptly contained and regularly removed from the mining site to reduce attractiveness to opportunistic predators such as ravens or coyotes that prey on desert tortoises.
- e. Mining activities will be designed to prevent increased erosion patterns and modification of down-slope habitat composition.
- f. Domestic dogs will either be restrained or prohibited from the project site.

g. Firearms shall be prohibited from the project site during operations.

h. The Bureau of Land Management (Bureau) at Ridgecrest shall be notified in advance of any planned exploration activities. The Bureau will be provided the opportunity to review planned exploratory actions and provide specific measures to protect sensitive species and associated habitats. During exploratory activities, including temporary excavation of trenches and holes, escape ramps consisting of loose earth deposited in the test hole or trench will be placed to facilitate the escape of any wildlife species that may inadvertently become entrapped. Such trenches or holes will also be inspected for entrapped wildlife prior to onset of activities and immediately prior to the end of each working day. A final inspection will also be made immediately before filling these holes or trenches. Any animals discovered will be allowed to escape before activities resume or will be carefully removed from the pit or trench and allowed to escape.

i. During placement of an ancillary waterline, which would be constructed entirely within the project area (Figure 1), mitigation measures a-h, n, o, r, u, and v shall also be followed.

j. Prior to onset of mining activities, all employees will be required to attend an endangered species education program. The program shall include information on the biology and occurrence of the desert tortoise and other sensitive species in the project area, measures being implemented for the protection of these species and their habitats during project activities, and means by which individual employees can facilitate this process. The employee education program must be received, reviewed, and approved by the Bureau, California Department of Fish and Game (DFG), and the Service at least 15 days prior to the presentation of the program. The program may consist of a class or video presented by a qualified biologist. Wallet-sized cards with important information for workers are recommended. All employees shall attend the education program prior to initiation of construction activities. The Rand Mining Company is responsible for ensuring that the education program is developed and presented prior to conducting activities. New employees shall receive formal approved training prior to working on-site. The program shall cover the following topics at a minimum:

- Distribution of listed and candidate species
- General behavior and ecology of these species
- Sensitivity to human activities

- Legal protection
- Penalties for violation of State and Federal laws
- Reporting requirements
- Project mitigation measures

k. Rand Mining Company will designate a specific individual that will serve as a contact representative between the Company and regulatory and reviewing agencies associated with desert tortoise mitigation and compliance procedures. Written notification of this individual will be provided to the Bureau, Service, and DFG.

l. In order to minimize any exposure risk to desert tortoises, a specifically designed fence will be constructed around all portions of the project that will be permanently disturbed. Fence design must be discussed with and found acceptable to the Service, Bureau, and DFG. The following design suggestions are provided at this time:

- The fence should be minimally 3 feet in height above the ground level
- The fence should be constructed of either 3-strand barbed wire or hogwire (the latter is recommended)
- The lower 1.5 feet of fence should have 0.5-inch mesh hardware cloth or other suitable material affixed
- The hardware cloth should be affixed at intervals not to exceed one foot using hog rings or other clamping devices
- the uppermost portion of the hardware cloth should not extend more than two inches above the lowermost wire strand if barbed wire is used
- the hardware cloth should be buried to a depth of one foot below ground, or the bottom one foot should be bent at a right angle towards the outside of the fence and covered with gravel or rocks to prevent animals from burrowing under the fence
- t-posts or other suitable anchoring posts should be placed at appropriate intervals (usually 10-16 foot spacing)
- treated peeler posts or other suitable anchoring devices should be placed at appropriate intervals to ensure fence stability
- the protective fence should be regularly inspected and repaired
- gates should be installed at appropriate access points and should be constructed to minimize clearance between the gate and the ground surface to deter ingress by desert tortoises

After fence installation, the authorized biologist shall conduct a complete survey for desert tortoises within the

fenced area. All desert tortoises found shall be marked and removed from the enclosure to a location acceptable to the Bureau. An identification number using acrylic paint and an epoxy covering shall be placed on the fourth left costal scute of all relocated desert tortoises. Photographs (35mm) of the carapace, plastron, and fourth left costal scute shall be taken. No notching is authorized. The authorized biologist shall be allowed some discretion to ensure that survival of such desert tortoises is likely.

m. Only a biologist authorized by the Service and DFG shall handle desert tortoises. Rand Mining Company shall submit the names of all proposed authorized biologists to the Service and DFG for review and approval at least 30 days prior to onset of activities. No project activities shall begin until an authorized biologist is approved. Authorization for desert tortoise handling will be granted by the Service under the auspices of the section 7 biological opinion for the project. Authorization for handling desert tortoises will be granted by DFG under a memorandum of understanding with the biologist.

n. Within 24 hours prior to onset of mine expansion activities, a pre-activity survey shall be undertaken to locate desert tortoises, burrows, and pallets. Those desert tortoise burrows located within the project area which cannot be avoided shall be excavated by hand during this same time period. All excavation of desert tortoise burrows shall be in accordance with the desert tortoise handling procedures developed by the Service. Measures will be taken to prevent desert tortoises from occupying the burrow sites. Burrows will be excavated and desert tortoises handled only by authorized biologists.

o. All desert tortoises which are found on the project site, whether above ground, in excavated burrows, or in open trenches, shall be placed 300 to 1,000 feet outside of the project boundary in the direction of undisturbed habitat. Desert tortoises shall be placed in the shade of a large, marked shrub. Each desert tortoise found within three hours of nightfall or when ambient temperatures exceed 90 degrees Fahrenheit shall be placed in a clean disposable cardboard box and held overnight in a cool location. The box shall be covered and kept in the possession of a designated biologist for release of each desert tortoise the next morning in a manner described above. New disposable latex gloves shall be used to handle all desert tortoises, used once, and discarded. All materials which come into contact with desert tortoises shall be used only once and then properly discarded to minimize contact with the causative factor(s) for upper respiratory tract disease (URTD). Desert

tortoises shall be kept upright at all times and handled in a secure but gentle manner to minimize stress including the possibility of voiding the bladder.

p. The authorized biologists shall maintain a record of all desert tortoises encountered during project activities. This information shall include for each desert tortoise:

- The locations and dates of observation
- General condition and health, including injuries and state of healing and whether animals voided their bladders
- Location moved from and location moved to
- Diagnostic markings (i.e. identification numbers or marked lateral scutes)

q. Employees shall be required to check under equipment and vehicles prior to moving them.

r. Toxic materials contained on the site shall be stored and used in a manner that prevents harm to desert tortoises.

s. Stockpiling of ore and tailings will maximize use of previously disturbed areas.

t. Upon locating a dead or injured desert tortoise, the Rand Mining Company shall notify the Bureau. The Bureau shall then notify the appropriate field office of the Service within three days of the finding. Written notification must be made within 15 days of the date and time of the finding or incident (if known) and include location of the carcass, a photograph, cause of death (if known), and other pertinent information. The remains shall be collected and frozen as soon as possible. Injured animals shall be transported to a qualified veterinarian for treatment at the expense of Rand Mining Company. If an injured animal recovers, the Service shall be contacted concerning final disposition of the animal.

u. Upon completion of mining activities, all equipment and materials shall be removed from the project site and the site reclaimed according to an approved reclamation plan.

v. Rand Mining Company shall acquire compensatory desert tortoise habitat in a ratio of 1:1 for each acre of desert tortoise habitat affected by the proposed project. These acquired desert tortoise habitats shall be secured at a location acceptable to the Bureau, Service, and DFG. Such acreages shall be conveyed in title to an entity mutually acceptable to the Bureau, Service, and DFG. Lands so

secured shall be protectively managed for the desert tortoise.

w. The Rand Mine expansion would occur within the boundaries of an area being addressed by the West Mojave Coordinated Management Plan. This Plan is currently being developed and is not available for public review. In such event that current measures to offset project-related impacts to desert tortoise habitats are inconsistent with those that are developed and presented within the West Mojave Coordinated Management Plan, Rand Mining Company shall contact the Bureau for further guidance.

x. No later than 90 days after completion of pre-activity surveys discussed above (item n.), Rand Mining Company and the authorized biologist shall prepare a report for the Service, Bureau, and DFG. The report shall document the effectiveness and practicality of the protection measures for listed and sensitive species encountered and their disposition. The report shall also provide recommendations for modifying these protection measures to enhance protection of such species or to make their implementation more workable to the applicant. The report shall provide an estimate of the actual acreage disturbed by the project.

Species Account

On August 4, 1989, the Service published an emergency rule listing the Mojave population of the desert tortoise as endangered. In a final rule dated April 2, 1990, the Service determined the Mojave population of the desert tortoise to be threatened. The desert tortoise is a large, herbivorous reptile found in portions of the California, Arizona, Nevada, and Utah deserts, and in Sonora and Sinaloa, Mexico. The threatened Mojave population is found in California, Nevada, and north of the Colorado River in Arizona and southwestern Utah. In the California deserts, desert tortoises are most active during the spring and early summer when annual plants are most common. Additional activity occurs during warmer fall months and after infrequent summer monsoons. Desert tortoises spend the remainder of the year in burrows, escaping the extreme weather conditions of the desert.

The Service recently issued a draft recovery plan for the Mojave population of the desert tortoise (Fish and Wildlife Service 1993). This draft plan proposes the establishment of 14 Desert Wildlife Management Areas (DWMAs) in six recovery units. Management in DWMAs would target the reduction or elimination of those factors which have caused declines in desert tortoise populations. The boundaries of proposed DWMAs are not precisely defined in the draft plan, but would be established by land

management agencies in coordination with the Service, California Department of Fish and Game, and others. The proposed project falls within or near the proposed Fremont-Kramer DWMA.

On August 30, 1993 a rule proposing designation of critical habitat for the Mojave population of the desert tortoise was published in the Federal Register (58 FR 45748-45768). The Rand Mine expansion is not within proposed critical habitat, however, proposed critical habitat surrounds the site.

Further information on the range, biology, and ecology of the desert tortoise can be found in Burge (1978), Burge and Bradley (1976), Hovik and Hardenbrook (1989), Luckenbach (1982), Turner et al. (1984), Weinstein et al. (1987), and Fish and Wildlife Service (1993).

Description of the Environment

The project area encompasses 1,645 acres of public land managed by the Bureau and 875 acres of private land located in the eastern Rand Mountains about 40 miles northeast of Mojave, California. Elevations range from 3,200 to 4,741 feet. The terrain is varied and includes hills and narrow drainages with more rugged terrain in the northern and northwestern portions of the project area (Rado 1993).

Vegetation can be categorized as the creosote series of Mohave desertscrub (Turner 1982). Dominant species include creosote (*Larrea tridentata*), bursage (*Ambrosia dumosa*), cheesebush (*Hymenoclea salsola*), and Mojave aster (*Machaeranthera tortifolia*). Blackbrush (*Coleogyne ramosissima*), wolfberry (*Lycium andersonii*), and Joshua tree (*Yucca brevifolia*) are common locally (Rado 1993). Further description of the fauna and flora of the area is found in Rado (1993).

Large portions of the project area have been disturbed by previous activities, particularly mining activity dating to the 1880's. Livestock grazing, off-highway vehicles, and transmission corridors have also modified the area's natural communities.

A survey for desert tortoises was conducted from February 2 to March 12, 1993 by walking transects spaced at 30-foot intervals (100% survey coverage) through all vegetated portions of the project area, with the exception of about 20 acres on slopes that were too steep to survey safely (Rado 1993). Survey methodology conformed to Service protocol (Service 1992), except no zone of influence transects were conducted and the surveys were conducted outside of the greatest period of desert tortoise activity (March 25 to May 21) (Rado 1993).

During the survey 131 corrected signs were found, including 15 live desert tortoises, 22 carcasses, 9 skeletal fragments, 89 burrows and pellets, and 16 scat. The majority of signs were within a small valley on the southwestern border of the site (Rado 1993). A disproportionate number of carcasses were found in hilly terrain of the northern Rand Mountains. These carcasses probably represent animals killed by golden eagles (Rado 1993).

Previous survey work demonstrated the desert tortoise is widespread in the project area (McMains 1987, Brown 1988, Gould 1988, Rado 1992). The eastern Rand Mountains supported an estimated density of 0-20 desert tortoises per square mile in the early 1980s (Berry 1984). The density of desert tortoise populations in this area of the western Mojave Desert has declined as much as 90% in recent years as a result of a variety of human impacts, predation, and URTD (Brussard et al. 1993).

Desert tortoise habitat has been categorized by the Bureau (1992) throughout the range of the desert tortoise in California. Habitat categories are defined by four criteria: 1) importance of the habitat to the maintenance of viable populations, 2) resolvability of conflicts, 3) desert tortoise density, and 4) population status (stable, decreasing, or increasing). Category I and II areas contain moderate to high desert tortoise densities and are often targeted for special protective or mitigative measures by the Bureau. Category III habitat support moderate to low densities which are generally not considered important for long-term maintenance of viable desert tortoise populations. The Service and DFG are in general concurrence with the Bureau's designation of desert tortoise habitat categories.

All but 40 acres of the project site are considered category III habitat. The remaining 40 acres, located in the western portion of section 34, T29S, R40E, is category I habitat, but no project activities are proposed there. The Randsburg-Johannesburg-Red Mountain mining district is surrounded by important desert tortoise habitat proposed as the Fremont-Kramer Desert Wildlife Management Area in the draft Desert Tortoise Recovery Plan (Service 1993) and the Fremont-Kramer proposed critical habitat unit (58 FR 45748-45768).

Analysis of Impacts

Project implementation would result in destruction or degradation of a maximum of 1,020 acres of category III desert tortoise habitat. Loss and degradation of habitat would occur as a result of initial blading of vegetation to construct heap leach pads, ore processing plants, and other facilities; blasting and excavation of ore; and crushing of vegetation with construction equipment. All desert tortoises occupying these 1,020 acre would

be relocated or killed (if not detected and relocated during preconstruction surveys).

Surveys located 15 desert tortoises on the project site which could be taken during project implementation. The actual number of desert tortoises subject to take may differ from this number due to immigration, emigration, mortality, and reproduction before the initiation of project construction. Additional desert tortoises could be collected, injured, or crushed by vehicles as employees travel to and from the mine. However, the employee education program proposed by the Rand Mining Company should reduce this form of take.

Common ravens are efficient predators of desert tortoises (Campbell 1983, Miller 1932) and are attracted to refuse, water sources, and perching sites. Rand Mining Company has proposed to strictly control the disposal of refuse. Nevertheless, improperly covered refuse and the presence of potential perching and nesting sites could increase local populations of ravens and lead to increased predation of desert tortoises at and near the proposed mine expansion.

The Rand Mining Company would provide 1:1 compensation for loss of desert tortoise habitat by acquiring and transferring to the Bureau or another conservation entity an acreage of high quality desert tortoise habitat equal in size to that destroyed. The purchase of prospective compensation lands east of the Rand Mountains is being investigated at this time. Protection of these lands would provide a corridor for movement of desert tortoises between the Rand Mountains and important habitat in the Superior-Cronese area to the east.

The Service believes the effects described above will not jeopardize the continued existence of the desert tortoise. We present this conclusion for the following reasons:

1. The proponent's project description includes features to minimize take of desert tortoises and mitigate the direct and indirect impacts of the proposed action.
2. Although the project site is surrounded by proposed critical habitat and areas identified as important for recovery for the desert tortoise, much of the area which would be disturbed by the project has been disturbed by previous mining activities and is not considered important desert tortoise habitat.

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur in the project area. Future Federal actions would be subject to the consultation

requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed project. Due to the extent of the lands in this area of the Mojave Desert administered by the Department of Defense and the Bureau, most of the actions which are reasonably expected to occur within the vicinity of the project site would be subject to section 7 consultations. However, some lands near the project site are privately owned and continued development of these non-Federal lands is anticipated. Rand Mining Company expects to hire eight new employees as a result of this action. Additional employment opportunities would occur through contracted services. Attraction of workers and their families to the area would likely increase adverse effects to desert tortoise resulting from new housing construction and other related human-caused mortality and habitat loss.

The Service has contacted the counties of San Bernardino, Kern, Riverside, Inyo, and Los Angeles (and the incorporated areas within the desert) regarding the listing of the desert tortoise and its implications for city and county-permitted activities. Many cities within the range of the desert tortoise in San Bernardino and Los Angeles counties have expressed interest in attempting to obtain a section 10(a)(1)(B) permit from the Service. Regional planning efforts, such as the West Mojave Coordinated Management Plan, could serve as model habitat conservation plans for local governments. Cumulative impacts of future State and private projects will be addressed in regional plans, such as this, and in the section 10(a)(1)(B) permit process.

Incidental Take

Section 9 of the Act prohibits the take of listed species without special exemption. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Under the terms of sections 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with this incidental take statement. Reasonable and prudent measures, as well as terms and conditions in this biological opinion are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit, as appropriate.

Over the life of the project, this biological opinion anticipates the following forms of take:

- 1) Three (3) desert tortoise in the form of direct mortality or injury resulting from project construction, operation, and maintenance.
- 2) Two (2) desert tortoises in the form of direct mortality resulting from increased predator densities and elevated predation of desert tortoises.
- 3) Twenty-five (25) desert tortoises through harassment associated with excavation of active burrows and movement of desert tortoises out of harm's way.

This biological opinion does not authorize any form of take not incidental to construction, operation, and maintenance of the Rand Mine expansion, Kern County, California. If the incidental take anticipated by this opinion is met, the Bureau shall immediately notify the Service in writing. If the incidental take anticipated by this biological opinion is exceeded, Rand Mining Company or its contractors shall cease the activity resulting in the take and the Bureau shall reinitiate formal consultation with the Service.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the incidental take authorized by this biological opinion:

1. Worker education programs, defined construction areas, and well-defined operational procedures shall be implemented. A desert tortoise-proof fence shall be constructed around the project site to avoid or minimize mortality of desert tortoises. Desert tortoises within the fence shall be relocated to areas outside the fence where their survival is likely. Prior to fence construction, activities which may result in a take of desert tortoise shall be monitored by an on-site qualified biologist(s).
2. Attraction of common ravens and other potential desert tortoise predators to the project area shall be reduced to the maximum extent possible.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the following terms and conditions are established to implement the reasonable and prudent measures described above. All terms and conditions except 4 and 15 are adapted from Bureau's biological assessment (Rado 1993), but most contain slight modifications or added detail.

1. Prior to onset of mining activities, all employees shall be required to attend an endangered species education program. The program shall include information on the biology and occurrence of the desert tortoise and other sensitive species in the project area, measures being implemented for the protection of these species and their habitats during project activities, and means by which individual employees can facilitate this process. The employee education program shall be received, reviewed, and approved by the Bureau, California Department of Fish and Game (DFG), and the Service at least 15 days prior to the presentation of the program. The program may consist of a class or video presented by a qualified biologist (a knowledgeable desert tortoise biologist approved by the Bureau). Wallet-sized cards with important information for workers are recommended. All employees shall attend the education program prior to initiation of construction activities. The Rand Mining Company is responsible for ensuring that the education program is developed and presented prior to conducting activities. New employees shall receive formal approved training prior to working on-site. The program shall cover the following topics at a minimum:

- Distribution of listed and candidate species
- General behavior and ecology of these species
- Sensitivity to human activities
- Legal protection
- Penalties for violation of State and Federal laws
- Reporting requirements
- Project mitigation measures

2. Rand Mining Company shall designate a "field contact representative" (FCR) who will be responsible for overseeing compliance with these terms and conditions and for coordination on compliance with the Bureau. The FCR shall have the authority to halt all construction, operation, and maintenance activities that are in violation of terms and conditions. The FCR shall have a copy of all terms and conditions.

3. A desert tortoise exclusion fence shall be constructed around all portions of the project site that will be disturbed by the project. The fence shall be constructed under the direction of a qualified biologist and shall be located to avoid all desert tortoise burrows. To the extent possible, the fence shall be located so that burrows are on the outside of the fence. The fence shall consist of 0.5-inch mesh hardware cloth that extends 18 inches above the ground and 12 inches below the surface of the ground. Where burial of the hardware cloth is not possible, the lower 12

inches shall be folded outward and fastened to the ground so as to prevent desert tortoise entry. Gates shall be desert tortoise-proof and shall remain closed except for passage of vehicles, unless the gates can be designed to exclude desert tortoises while open. The fence shall be supported sufficiently to maintain its integrity.

4. No project activities which may result in a take of desert tortoise shall occur prior to construction of the tortoise-proof fence unless a qualified biologist is on-site to insure such activities would not endanger desert tortoises.

5. Following desert tortoise-proof fencing, a qualified biologist shall survey the entire enclosed area. All desert tortoises within the area to be fenced shall be relocated by an authorized biologist(s) (see term and condition 6 for definition) pursuant to terms and conditions 15, 16, 17, and 18. All desert tortoise cover sites within the fence shall be examined for occupancy. Unoccupied cover sites and those from which desert tortoises are removed shall be collapsed to prevent further use. When fencing is complete, and the authorized biologist(s) has removed all desert tortoises from within the fenced area, construction and other activities inside the fence may proceed without the presence of a qualified or authorized biologist.

6. Only biologists authorized by the Service shall handle desert tortoises. Rand Mining Company or the Bureau shall submit the name(s) of the proposed authorized biologist(s) to the Service for review and approval at least 15 days prior to the onset of activities. No construction or operational activities shall begin until an authorized biologist is approved.

7. During mining and other project activities, work staging areas and storage of equipment and vehicles shall occur only in areas that will be subject to permanent disturbance by project activities, or to areas previously disturbed. Temporary or inadvertent disturbance to remaining portions of the area shall be minimized by: staking, "flagging", or otherwise clearly marking the boundaries of the mining area; notifying employees of the boundaries of construction areas and the need to avoid disturbance to remaining areas; and posting signs or erecting temporary fencing at access points to limit access to authorized vehicles and equipment only. All employees shall be instructed that their activities shall be confined to locations within flagged or marked areas.

8. The area of disturbance shall be confined to the smallest practical area, considering topography, placement of facilities, public health and safety, and other limiting factors.

9. Existing routes of travel shall be used during project activities to the maximum extent practical in order to minimize any disturbance to desert tortoise habitat not slated for development. Speed limits on unposted access roads leading to and from the mining site, ore processing areas, equipment stockpile or overburden areas, and other facilities shall not exceed 25 miles per hour. Project-related vehicle use shall be confined to designated routes.

10. Trash and food items shall be promptly contained and regularly removed from the mining site to reduce attractiveness to common ravens and coyotes that prey on desert tortoises.

11. Project features shall be designed to prevent increased erosion patterns and modification of down-slope habitat composition.

12. Domestic dogs shall either be restrained or prohibited from the project site prior to construction of the desert tortoise exclusion fence.

13. Firearms shall be prohibited from the project site during operations.

14. The Bureau's Ridgecrest Resource Area Office shall be notified in advance of any planned exploration activities. The Bureau shall be provided the opportunity to review planned exploratory actions and provide specific measures to protect desert tortoises and their habitats.

15. If, throughout the project life, desert tortoises are found above ground or within burrows inside the desert tortoise-proof fence, they shall be relocated by an authorized biologist (see term and condition 6 for definition) a short distance outside the fence. If the relocation occurs in the season of above-ground activity, the desert tortoise shall be placed in the mouth of a burrow of appropriate size or in the shade of a large shrub. If the relocation is not in the season of above-ground activity, the desert tortoise shall be moved on a seasonably warm day and placed at the mouth of a burrow of appropriate size. All excavation of desert tortoise burrows shall be done by hand tools, either by or under the direction of a qualified biologist. If the relocation occurs outside of the season of above-ground activity and the desert tortoise

does not enter the burrow, or a burrow is not available, an artificial burrow shall be constructed and the desert tortoise placed within it. Artificial burrows shall be at least 6 feet in length and of the same diameter, depth, and orientation as the one in which the desert tortoise was found or as appropriate for the size of the subject desert tortoise. Wood or plastic materials may be used to strengthen the tunnel and/or chamber of the burrow. In coordination with the Service, the authorized desert tortoise biologist shall be allowed some judgement and discretion to ensure that survival of the desert tortoise is likely.

16. Desert tortoises shall be handled only by the authorized biologist and only when necessary. In handling desert tortoises, the authorized biologist shall follow general handling protocols (Arizona Game and Fish Department et al. 1991). New latex gloves shall be used when handling each desert tortoise to avoid the transfer of infectious diseases between animals. Replacement of lost fluids with a syringe, drawing of blood, and notching of sheels is not authorized. If a desert tortoise needs to be moved within three hours of nightfall, or when ambient temperatures are extremely low (i.e., less than 40 degrees Fahrenheit) or high (exceeds 90 degrees Fahrenheit), it shall be placed in a clean disposable cardboard box and held overnight in a cool location. The box shall be covered and kept in possession of an authorized biologist for release of each desert tortoise the next morning in the manner described in term and condition 15. Cardboard boxes used to hold desert tortoises shall be new, used once, and discarded. All materials which come into contact with desert tortoises shall be used only once and then properly discarded to minimize contact with the causative factor(s) for URTD or other diseases.

17. All relocated desert tortoises shall be marked for future identification. An identification number using the acrylic paint/epoxy covering technique shall be placed on the fourth left costal scute as described in Arizona Game and Fish Department et al. (1991). Slide photographs (35mm) shall be taken of the carapace, plastron, and fourth costal scute.

18. The authorized biologists shall maintain a record of all desert tortoises encountered during project activities. This information shall include for each desert tortoise:

- The locations and dates of observation

- General condition and health, including injuries and state of healing and whether animals voided their bladders
- Location moved from and location moved to
- Diagnostic markings (i.e. identification numbers of marked lateral scutes)

19. Prior to moving a vehicle, workers shall inspect for desert tortoises under the vehicle. If a desert tortoise is present, the authorized biologist shall carefully move or direct the movement of the vehicle only when the desert tortoise would not be injured, or the desert tortoise shall be allowed to move out from under the vehicle on its own. If the desert tortoise is within the fenced area (or area to be fenced) the desert tortoise shall be relocated in accordance with terms and conditions 15, 16, 17, and 18.

20. Toxic materials contained on the site shall be stored and used in a manner that prevents harm to desert tortoises.

21. Stockpiling of ore and tailings shall maximize use of previously disturbed areas.

22. Upon completion of mining activities, all equipment and materials, shall be removed from the project site and the site reclaimed according to a reclamation plan approved by the Bureau. Site reclamation shall include the removal of all hazards to desert tortoises, such as filling of trenches and removal of contaminants. The desert tortoise exclusion fence shall be removed only after such hazards are removed and all project activities which may result in a take of desert tortoises have ceased.

23. Rand Mining Company shall acquire compensatory desert tortoise habitat in a ratio of 1:1 for each acre of desert tortoise habitat affected by the proposed project. The acquired desert tortoise habitat shall be secured at a location(s) acceptable to the Bureau, Service, and DFG. Such acreages shall be conveyed in title to an entity mutually acceptable to the Bureau, Service, and DFG. Lands so secured shall be protectively managed for the desert tortoise.

24. In such event that current measures to offset project-related impacts to desert tortoise habitats are inconsistent with those presented in the final Environmental Impact Statement and the Service's biological opinion for the West Mojave Coordinated Management Plan, Rand Mining Company shall contact the Bureau for further guidance.

25. No later than 90 days following completion of pre-activity surveys discussed above (term and condition 5), Rand Mining Company and the authorized or qualified biologist shall submit a report to the Service's Ventura Field Office. The report shall document the effectiveness of the desert tortoise mitigation measures, the number of desert tortoises excavated from burrows, and the number of desert tortoises moved from construction sites. The report shall make recommendations for modifying or refining these terms and conditions to enhance desert tortoise protection and reduce needless hardship on the project proponent. If desert tortoises are taken after completion of the construction phase, such take shall be reported to the Service pursuant to the following section.

Disposition of Dead, Injured, or Sick Desert Tortoises

Upon locating dead, injured, or sick desert tortoises, initial notification must be made to the Service's Division of Law Enforcement in Torrance, California at (310) 297-0062 within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph, and any other pertinent information. The notification shall be sent to the Service's Torrance office with a copy to the Ventura Field Office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible state. If possible, the remains of intact desert tortoises shall be placed with educational or research institutions holding the appropriate State and Federal permits. If such institutions are not available or the shell has been damaged, the information noted above shall be obtained and the carcass left in place. Marking the carcass in a manner that would not be toxic to other wildlife to ensure that it would not be re-recorded in the future, should be considered.

Arrangements regarding proper disposition of potential museum specimens shall be made with the institution prior to disposition. Injured animals should be transported to a qualified veterinarian by an authorized desert tortoise biologist. Should any treated desert tortoises survive, the Service should be contacted regarding the final disposition of the animals.

Conservation Recommendations

In furtherance of the purposes of sections 2(c) and 7(a)(1) of the Act that mandate Federal agencies to utilize their authorities to carry out programs for the conservation of listed species, we recommend implementing the following action:

1. Rand Mining Company should monitor the movements, survivorship, and condition of relocated desert tortoises to evaluate the effectiveness of the relocation. This information could be used to develop more successful relocation techniques.

The Service requests notification of the implementation of this conservation recommendation so we can be kept informed of actions that either minimize or avoid adverse effects, or that benefit listed species or their habitats.

Conclusion

This concludes formal consultation on the construction and operation of the Rand mine expansion in Kern County, California. Reinitiation of formal consultation is required if: 1) the amount or extent of incidental take is reached; 2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by this action (50 CFR 402.16). Any questions or comments should be directed to Ray Bransfield of the Ventura Field Office at (805) 644-1766.



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APPENDIX M

Groundwater Monitoring Plan for the Rand Mining Company Production and Monitoring Wells

WATER LEVEL MONITORING PROGRAM

RAND MINING COMPANY FREMONT VALLEY GROUNDWATER WELLS

I. Introduction

This monitoring program describes the procedures for collection and recording of water level data from Rand Mining Company (RMC) groundwater production and observation wells located in the northeastern Fremont Valley to be used to determine water level responses to pumping in the vicinity of the production wells.

Currently RMC has four (4) production wells (RMC-1, RMC-2, RMC-3, and RMC-4) located in the northeastern Fremont Valley. Standard RMC pumping operations include pumping production well RMC-4 at approximately 400 to 600 gallons per minute (gpm) for 10 to 24 hours daily. This water production is periodically augmented by pumping production well RMC-3 at approximately 60 to 100 gpm and production wells RMC-1 and RMC-2 at approximately 10 gpm each. RMC has indicated that an additional production well may be installed in the vicinity of RMC-4 to further augment RMC's water supply. There is one (1) observation well for production well RMC-4. This observation well, OW-1, is located approximately 150 feet from RMC-4. Production wells RMC-1 through RMC-3 do not have observation wells.

Water levels measured in RMC wells will reflect pumping, recovery, and static water levels. Pumping water levels are defined as water levels measured in production or observation wells while the production well is pumping. Recovery water levels are defined as water levels measured in production or observation wells after the production well stops pumping and which are lower than static water levels. Static water levels are defined as water levels measured in production or observation wells immediately before the start of pumping or between pumping periods. After a pump is shut off, the time it takes to regain the pre-pumping static water level will typically range between two-thirds to the full duration of the pumping period. For example, if continuous pumping lasted 4 days, static water levels should be regained in the production and observation well within three (3) to four (4) days. If extended, continuous pumping is performed (three (3) to four (4) months, for example), pre-pumping static levels may not be regained after pumping ceases due to seasonal changes, regional water level declines, or dewatering of the aquifer. In this case, the static water level is the water level measured immediately before the start of the next pumping period.

II. Water Level Monitoring Program Requirements

- Pumping rates and durations shall be recorded for all existing and new RMC production wells.

Water Level Monitoring Program
Rand Mining Company
Fremont Valley Groundwater Wells

- Water levels shall be measured in all existing and new RMC production and observation wells.
 - Water levels in all production wells shall be measured immediately prior to the start and completion of each pumping period if the startup or shutdown occurs during daylight hours.
 - Between pumping periods, water levels shall be measured at least monthly in production wells RMC-1 through RMC-3.
 - Water levels shall be measured at least weekly in production well RMC-4 and observation well OW-1 during or between pumping periods, if possible.
 - Water levels in observation well OW-1 shall be measured with the same frequency as production well RMC-4.
 - Water levels shall be measured at least weekly in any new production or observation wells during or between pumping periods, if possible.
- A marked permanent measuring point shall be established for each production and observation well.
 - The permanent measuring point shall be surveyed to a local datum point in order to calculate water level elevations.
- Production wells RMC-1, RMC-2, RMC-3 and RMC-4 water levels shall be measured using an air line pressure gauge.
 - Water levels shall be obtained by measuring air line pressures and converting the pressure measurement to feet of water.
- Water levels in new production or observation wells shall be measured using either an air line pressure gauge or a calibrated electronic water level indicator. If calibrated electronic water level indicators are used, then conduct the following.
 - The water level indicator shall be equipped with a plastic, laminated, two-lead cable with a weighted electrode attached to the end of the cable.
 - The cable shall have permanent graduated markings at least every 10 feet and be a minimum length of 600 feet.
 - The water level indicator shall be calibrated at least four (4) times a year by comparing the permanent markings on the cable of the indicator to those on a steel measuring tape.
 - All water level measurements shall be collected at the permanent measuring point for each production and observation well.

Water Level Monitoring Program
Rand Mining Company
Fremont Valley Groundwater Wells

III. Monitoring Program Procedures

A. Pumping Data Collection Procedures for Production Wells

- Prior to the start of each pumping period, record the totalizer reading for the well to be pumped. Include the date and time of the reading.
- Record the date and time when the pump is turned on for each pumping period.
- Record the date and time when the pump is turned off for each pumping period.
- After the end of each pumping period, record the totalizer reading for the well pumped. This data can be recorded prior to the next start-up of the well.
- Calculate the average flow rate during each pumping period. Subtract the initial totalizer reading from the final totalizer reading to obtain the total gallons pumped. Calculate the total time of pumping in minutes. The average flow rate for the pumping period is the total gallons pumped divided by the total time of pumping in minutes.

B. Water Level Data Collection Procedures for Wells Measured Using an Air Line Pressure Gauge

- Water level data for production wells RMC-1, RMC-2, RMC-3 and RMC-4 shall be obtained using air line pressure measurements.
- Open the supply gas valve to fill the air line. This expels water from the air line located in the well. The pressure gauge will show an increase in pressure and then stabilize when the water is forced out of the air line.
- Turn off valve to the supply gas. The pressure gauge will show a decrease in pressure and then stabilize as the water comes back into the air line.

Water Level Monitoring Program
Rand Mining Company
Fremont Valley Groundwater Wells

- Estimate and record the pressure reading (p) in pounds per square inch (psi) to the nearest 0.1 psi. Record if production well RMC-4 is pumping, and include the date and the time of the pressure reading.
- Convert the pressure value into feet of water (f). Multiply the pressure reading by the conversion factor 2.31 feet of water per psi.
- Calculate the depth of water (d). Subtract the feet of water (f) from the length of the air line. If the air line length is modified in the future, this calculation needs to be adjusted as well.
- Record the date, time, and reading of the engine tachometer, located north of the well head.

C. Water Level Data Collection Procedures for All Wells Measured With a Calibrated Electronic Water Level Indicator

- Lower the probe and cable of the calibrated electronic water level indicator slowly to: 1) avoid frictional heating of the cable rubbing against the side of the well casing or sounding tube; 2) avoid possible entanglement of the cable in the pumping equipment; and, 3) prevent the probe from displacing water in the casing that would cause a false water level measurement.
- Measure the depth to water in each well twice with the calibrated electronic water level indicator. The variation between the two (2) measurements must be less than 0.1 feet. Continue to measure the depth to water until a difference of less than 0.1 feet between consecutive measurements is obtained. The water level indicator does not need to be removed from the well between measurements.
- Record the depth to water, date, time of measurement, and if the production well is pumping.
- Keep the cable and probe of the water level indicator clean. The cable should be wiped clean with a wet paper towel as the cable and probe is removed from each well. Periodically, the probe should be rinsed with distilled or deionized water. Avoid touching anything with the cable and probes that could effect the water quality of the production well, such as the ground or oily surfaces.

Water Level Monitoring Program
Rand Mining Company
Fremont Valley Groundwater Wells

IV. Data Management

The data collected shall be maintained in a field notebook. The field notebook shall be copied on a regular basis, and the copies entered into a file maintained in the RMC office. Data from each well shall be recorded individually.

A monitoring database shall be developed to maintain pumping and water level data records. The data base shall be established in a spreadsheet format, and updated monthly.

- Pumping and water level data from each well shall be entered in a separate file of the database.
- After data entry, all new data entered into the database shall be printed. The printed data shall be checked against the field data sheets and errors corrected.
- Water level hydrographs shall be prepared monthly from static water elevation data obtained from all observation wells and all production wells other than RMC-1, RMC-2, or RMC-3. Since water level data should be collected weekly from these wells, a maximum of only one day from each week should be needed to be included on the hydrograph. The same day each week should be selected, if possible.
- Water level hydrographs shall be produced quarterly from static water level elevation data obtained from production wells RMC-1, RMC-2, and RMC-3.
- A plot of pumping water levels versus pumping rate shall be prepared from the data obtained from each production well. The maximum measured drawdown during any pumping period shall be used for this plot. This data will aid in determining the potential well yield from each production well and in determining if pump maintenance is required.

V. Projected Drawdown at Observation Well OW-1

Drawdown at observation well OW-1 has been projected for various pumping rates and time periods using the Theis analytical method. The Theis method assumes a homogeneous aquifer of unlimited extent and continuous pumping periods. This approach does not incorporate the potential effect of the El Paso Mountain or Garlock Faults on drawdown in the vicinity of production well RMC-4. Thus, the projected

Water Level Monitoring Program
Rand Mining Company
Fremont Valley Groundwater Wells

drawdowns provided in this monitoring plan are preliminary and included only as potential "flag" values for comparison with actual measured values for various pumping scenarios.

Drawdown projections for observation well OW-1 using the Theis method were based on the results of the hydrogeological analysis performed for northern Fremont Valley. For the purpose of this analysis, the estimated values of transmissivity and storativity were 44,900 gallons per day per foot and 0.04, respectively. Drawdown at observation well OW-1 has been projected for pumping rates greater than 500 gpm since RMC will periodically require water production rates up to approximately 1,000 gpm. To obtain the additional water production, RMC is considering installing another production well in the vicinity of production well RMC-4. The projected drawdowns for observation well OW-1 assumes that a new production well would be located less than 500 feet from production well RMC-4 and would be constructed in a similar manner as RMC-4.

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